DOCUMENT RESUME

ED 135 441	JC 770 172

TITLE	Developing a Model for Predicting Success in Florida Community College Business Courses for Recent High School Graduates.
PUB DATE	75
NOTE	137p.; Ed.D. Dissertation, Nova University
EDRS PRICE	MF-$0.83 HC-$7.35 Plus Postage.
DESCRIPTORS	Academic Achievement; *Business Education; Community Colleges; Doctoral Theses; *Grade Prediction; Grades (Scholastic); *High School Graduates; *Junior Colleges; Models; Multiple Regression Analysis; *Predictive Ability (Testing); Predictor Variables; Standardized Tests; Student Ability
IDENTIFIERS	Florida; Florida Twelfth Grade Test

ABSTRACT

This document describes a model for predicting the success of recent high school graduates in Florida community college business courses. In the development of the model, test scores from the Florida Twelfth Grade Test and grades earned during the senior year by high school graduates from eleven high schools in Brevard County entering their first semester business courses at Brevard Community College were analyzed in terms of their relationship to the students' first semester academic success in selected business courses. Multiple regression analysis indicated that the best predictor of student success was the student's senior year high school grades and the next best predictor was the student's score on the Florida test. These variables collectively accounted for approximately 40% of the variance in student performance in selected business courses. Prediction tables were developed with the result that academic success in selected business courses could be predicted for about 68% of the students within plus or minus .78 of a grade point of the predicted value. While a large percentage of the variance remained unexplained, it was felt that the model was nonetheless useful for the development of simple prediction tables for use in student advisement. Procedures for replicating this model in other institutions are appended. (JDS)

Documents acquired by ERIC include many informal unpublished materials not available from other sources. ERIC makes every effort to obtain the best copy available. Nevertheless, items of marginal reproducibility are often encountered and this affects the quality of the microfiche and hardcopy reproductions ERIC makes available via the ERIC Document Reproduction Service (EDRS). EDRS is not responsible for the quality of the original document. Reproductions supplied by EDRS are the best that can be made from the original.

ED135441

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

DEVELOPING A MODEL FOR PREDICTING SUCCESS IN FLORIDA COMMUNITY COLLEGE BUSINESS COURSES FOR RECENT HIGH SCHOOL GRADUATES

Maurice H. Boutelle

A MAJOR APPLIED RESEARCH PROJECT PRESENTED TO NOVA
UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR
THE DEGREE OF DOCTOR OF EDUCATION

NOVA UNIVERSITY

1975

JC770 172

ACKNOWLEDGEMENTS

The writer is indebted to Don A. Morgan under whose guidance this study was conducted; to William C. Prentiss, the Nova Orlando Cluster Coordinator and second reader, for his assistance throughout the course of this study, and to Ross E. Moreton for his constructive suggestions and encouragement.

The writer is also indebted to the following individuals who were ever ready to provide guidance, assistance, and expertise whenever needed; A. Perkins Marquess, Everett Whitehead, and Nicholas A. Beninate. A special measure of appreciation is due Joel F. Sherman for providing invaluable assistance with computer programs and expertise in the use of the computer terminal.

Owen McDowell and his entire staff in the registrar's office at Brevard Community College were particularly helpful during all phases of the data collection activities of this study.

Finally, the deepest gratitude must be accorded to Dorthy Hinshaw who gave so unstintingly of her time and skill in the typing and retyping of this study.

Abstract of a Major Applied Research Project Presented to Nova University in Partial Fulfillment of the Requirements for the Degree of Doctor of Education

DEVELOPING A MODEL FOR PREDICTING SUCCESS IN FLORIDA COMMUNITY COLLEGE BUSINESS COURSES FOR RECENT HIGH SCHOOL GRADUATES

By
Maurice H. Boutelle

1975

A model has been developed for predicting success in Florida community college business courses for recent high school graduates. The relatively high attrition rate in business courses required for completion of Associate of Arts and Associate of Science degrees, the growing student population, and the hope that individual wasted effort and expenditures be reduced to a minimum prompted the study reported.

An effective prediction device should make use of tools available in order to help counselors and business administration instructors perform their counseling and advising duties. The development of a relatively easily replicated and understood prediction instrument, designed to make use of available information contained in student records, could be an important aid to increasing counseling effectiveness, reducing student attrition rate, and helping business administration instructors attain hoped for outcomes.

Procedures followed in the development of this model included an analysis of select test scores (Florida twelfth grade testing program) and academic backgrounds (grades earned during the senior year in high

school) of Brevard County high school graduates (eleven different high schools) entering their first semester business courses at Brevard Community College (BCC). The dependent variable measured was the first semester academic success these students achieved in select business courses.

Correlations between selected entry variables and achievement in four different first semester business courses (Principles of Marketing, Economics I, Accounting I, and Introduction to Business) were determined and analyzed. Based on the results of the correlation analyses, the number of entry or prediction independent variables was reduced to two.

With the BCC grade earned in select courses during 1973-74 used as the dependent variable (criterion) and two selected variables (grade point average for the senior year in high school as the first and any of the five sections or total score of the Florida tests, having the highest predictive potential as the second) used as independent variables a multiple regression analysis was computed for each dependent variable.

The individual course regression equations were used as the bases for developing simple prediction tables which could be used by counselors, para-professional program advisors, and business administration instructors in performing their counseling duties.

Further analysis of the computed coefficient of determination revealed that approximately forty percent of the variations in grade earned in the Economics I courses could be attributed to variation in the entry variables used (GPA and a Florida test percentile score) while sixty percent of the variations in grade earned were unexplained. The standard error of the estimate indicated that about sixty-eight percent of the students with given scores in these entry variables will earn within plus or minus .78 of a grade point of the predicted value. Similar predictions or estimates of success can be made from the three other prediction tables.

The results of this study, in an abbreviated form, were compiled as a model package which could be used by other community/junior colleges in Florida to develop and prepare similar prediction tables for their own institutions. Essentially the model demonstrates how to replicate the study in any Florida community college. The applicability of this model is limited to Florida because of the utilization of the Florida twelfth grade testing program. However, community colleges located elsewhere could substitute other test scores.

The large percentage of unexplained variation in achievement as compared with predicted subject grade suggested that students be advised of this fact and only those with very low predictions be discouraged from taking the course work area represented. However, this much advice should be helpful.

TABLE OF CONTENTS

Page

ACKNOWLEDGEMENTS ii

ABSTRACT iii

LIST OF TABLES ix

CHAPTER

I. BACKGROUND AND STATEMENT OF THE PROBLEM 1
  - INTRODUCTION 1
  - HYPOTHESES 3
  - SIGNIFICANCE OF THE STUDY 3
  - BACKGROUND OF THE PROBLEM 6
  - SUMMARY AND STATEMENT OF THE PROBLEM 9
  - ASSUMPTIONS 9
  - LIMITATIONS 10
  - ORGANIZATION OF THE STUDY 12

II. REVIEW OF THE LITERATURE AND STATEMENT OF RESEARCH QUESTIONS 13
  - ATTRITION AND RECRUITING 14
  - PREDICTING COLLEGE ACHIEVEMENT 16
    1. Independent Variables Considered............. 16
       a. High school grades and achievement test scores 16
       b. Socio-economic level - economically disadvantaged, and minority - race, sex, and marital status 20
       c. School related factors 22

TABLE OF CONTENTS (Cont'd)

Page

CHAPTER (Cont'd)

II. REVIEW OF THE LITERATURE AND STATEMENT OF RESEARCH QUESTIONS (Cont'd)

d. Test scores 23

e. Predictions that all students will receive a grade point average of 2.00 or better 30

f. Educational and socio-economic information 31

g. Self-made academic predictors 32

h. Class size 35

i. Other 36

EFFICIENCY OF PREDICTIONS 36

1. Validity study report 36

2. Prediction studies based on ACT 37

3. Florida State-Wide Twelfth Grade Testing Program 38

SUMMARY AND STATEMENT OF RESEARCH QUESTIONS 38

Major Issue 39

Research Questions 39

III. PROCEDURES 41

DESCRIPTION OF THE FIELD SITUATION IN WHICH THE DATA WAS COLLECTED 41

OVERALL DESIGN FOR ANSWERING RESEARCH QUESTIONS 42

TABLE OF CONTENTS (Cont'd)

Page

CHAPTER (Cont'd)

III. PROCEDURES (Cont'd)

DETAILED DESCRIPTION OF STATISTICAL AND COMPUTER PROCEDURES 55

STATISTICAL PROCEDURES FOR ANSWERING THE RESEARCH QUESTIONS 58

IV. RESULTS AND DISCUSSION 59

RESULTS 59

1. Principles of Marketing 74

2. Principles of Economics I 74

3. Accounting I 74

4. Introduction to Business 75

V. SUMMARY, FINDINGS, IMPLICATIONS AND STRATEGY FOR IMPLEMENTATION, AND RECOMMENDATIONS 82

SUMMARY 82

FINDINGS 83

IMPLICATIONS AND STRATEGY FOR IMPLEMENTATION 85

RECOMMENDATIONS 86

BIBLIOGRAPHY 88

APPENDIX 93

LIST OF TABLES

Table Page

1. BREVARD COUNTY HIGH SCHOOL GRADUATES ENROLLED IN BREVARD COMMUNITY COLLEGE WHO INDICATED "BUSINESS" AS THEIR MAJOR PROGRAM 45
2. BREVARD COUNTY HIGH SCHOOL GRADUATES (1973 AND 1974) ENROLLED IN BUSINESS COURSES AT BREVARD COMMUNITY COLLEGE 47
3. SAMPLE STUDENT DATA - ACCOUNTING SAMPLE 52
4. A COMPARISON OF GRADES EARNED BY SAMPLE STUDENTS IN SELECTED BUSINESS COURSES 60
5. A COMPARISON OF GRADES EARNED BY SAMPLE STUDENTS IN SELECTED BUSINESS COURSES - REVISED 61
6. A COMPARISON OF SEX OF THE SAMPLE STUDENTS 62
7. A COMPARISON OF RACE OF THE SAMPLE STUDENTS 63
8. PRINCIPLES OF MARKETING - SAMPLE STUDENTS - ACADEMIC PERFORMANCE 65
9. PRINCIPLES OF ECONOMICS - SAMPLE STUDENTS - ACADEMIC PERFORMANCE 66
10. ACCOUNTING I - SAMPLE STUDENTS - ACADEMIC PERFORMANCE 67
11. INTRODUCTION TO BUSINESS - SAMPLE STUDENTS - ACADEMIC PERFORMANCE 68
12. PRINCIPLES OF MARKETING - CROSS CORRELATION MATRIX 69
13. ECONOMICS I - CROSS CORRELATION MATRIX 70
14. ACCOUNTING I - CROSS CORRELATION MATRIX 71
15. INTRODUCTION TO BUSINESS - CROSS CORRELATION MATRIX 72
16. RESULTS OF MULTIPLE REGRESSION ANALYSES AND STATISTICAL COMPUTATIONS 76
17. PRINCIPLES OF MARKETING - GRADE PREDICTIONS 77

LIST OF TABLES (Cont'd)

Table Page

18. PRINCIPLES OF ECONOMICS I - GRADE PREDICTIONS 78

19. ACCOUNTING I - GRADE PREDICTIONS 79

20. INTRODUCTION TO BUSINESS - GRADE PREDICTIONS 80

DEVELOPING A MODEL FOR PREDICTING SUCCESS IN FLORIDA COMMUNITY COLLEGE BUSINESS COURSES FOR RECENT HIGH SCHOOL GRADUATES

CHAPTER I

BACKGROUND AND STATEMENT OF THE PROBLEM

INTRODUCTION

Brevard Community College (BCC), located in central Florida, has developed into a multi-campus community college. A ten year Master Development plan completed by the college under the supervision of Wattenbarger (1973) and his associates of the University of Florida revealed that the total number of persons served by Brevard Community College may double during the coming decade. Thus, projections are that as many as 59,000 persons could receive educational services of one type or another at Brevard Community College in 1983-84.

There have been relatively high attrition rates at BCC in business courses required for completion of an Associate of Arts or Associate of Science degree in business programs. An open door policy has permitted unrestricted admission to business courses and has undoubtedly accounted for some of the attrition. However, many other aspects of the attrition problem should be considered. Community college counselors are primarily responsible for assisting students asking counselors for guidance in making educational and program decisions. Counselors should deal with each student individually in terms of overall capabilities. It should be incumbent on counselors to take advantage of all available tools in assisting students with selection of courses in line with capabilities and maximum chance of success.

The growing student population has taxed the efforts of counselors to aid each student contacted to fully understand personal capabilities and the probabilities of success in the various options open. The current economic situation suggests that wasted effort and expenditures be reduced to the minimum. A reliable prediction device should be one of the tools available to help counselors increase effectiveness. A graduating high school student in Florida probably has limited knowledge of the options open; of equal importance is the fact that personal capabilities to pursue goals in special fields with reasonable chance of success are even less known.

The counselor has many records of student achievement which should assist in evaluating the student's probability of success in chosen fields. The relatively high attrition rate in Brevard Community College business courses suggests there may be a lack of standardized or systemized procedures for making maximum use of student records during counseling activites. The development of a prediction instrument designed to make full use of information contained in the student's records, could be a major step toward increasing the counselors' effectiveness and consequently reducing the student attrition rate. This, in turn, will enable the business instructors to attain the hoped for outcome in teaching and make for full utilization of college facilities.

HYPOTHESIS

The principal hypothesis of this research is that a model predicting success in first semester business courses at Brevard Community College can be developed, and that this model may be effectively utilized by other community colleges in the state of Florida.

SIGNIFICANCE OF THE STUDY

The majority of Brevard Community College students reside in Brevard County, and a major source of full-time students is from high schools in the Brevard County area. Approximately thirty-five percent of the 1972 and 1973 high school graduates from the eleven Brevard County high schools attended Brevard Community College. (Wattenbarger, 1973:37) Records reveal that about the same percentage of the 1974 high school graduates from Brevard County attend BCC.

Brevard County is located in the middle of a space industry area which adds another dimension to the students served by BCC. Personnel associated with the space industry have frequently been subjected to moves and relocation problems which may have had an effect on student attitudes and performance at the high school and college level. Though this question is not addressed in this research, it suggested the need for locally generated and validated prediction.

No available information indicates that a study similar to that proposed in this research project has been accomplished in this institution or in any other Florida community college. Similar predictive studies have been conducted at other colleges in the nation.

although none are the same as this proposal which is seen essentially as a research model for discriminate prediction.

An analysis of sixty one business classes in eleven different subjects covering the August - December, 1974 semester, was conducted. The analysis revealed an attrition rate from the various classes ranging from a high of forty-three percent to a low of fifteen percent. Based upon the total students registered in those sixty-one classes (2,003) and the total attrition (577) the overall attrition rate was twenty-nine percent. Some administrators and instructors consider such a high rate as an unacceptable situation. Contact with administrators and instructors at other Florida community colleges indicates this is a normal rather than an unusual situation. In view of this situation, any efforts to reduce the attrition rate appear to be justified and are worthy of consideration.

It is hoped that the findings of this research will lead to more effective placement of students and a consequent reduction in the attrition rate in first semester business courses at BCC. The use of predictions based upon the regression analyses may help counselors do a better job of guiding students by making more effective use of available data. Greater student success and self-satisfaction due to more effective placement is anticipated. More efficient guidance services should produce a higher percentage of successful students, thereby yielding a higher return on human and social resource investments.

Less financial loss by students and more consistent progress toward reaching college goals, may be some of the positive results of the findings. Each student who receives a failing grade or who is unable to complete a course suffers a financial as well as a time loss and has a feeling of frustration due to being delayed in meeting his objective - obtaining a degree or at least successful completion of a course. If a student's failure or attrition is caused, even in part, by poor counseling or guidance, it adds to his frustration and creates an unfavorable attitude toward the college itself. However, in many instances the "poor counseling and guidance" was received from students rather than from one of the professional counselors.

It is hoped that the findings of this project will lead to more effective utilization of faculty and college facilities and a consequent reduction of financial losses to the institution by reducing the attrition rate. The size of most of the classrooms at BCC limit the enrollment in any particular class section. A high attrition rate results in only partial use of the instructor's time and the college facilities. The overall attrition rate from the sixty-one business classes previously discussed suggests that the classrooms and the instructors in these classes at the end of the semester were only about seventy percent effective. Approximately thirty percent of the classrooms were unoccupied and the instruction was being received by thirty percent less students than originally scheduled. From a business viewpoint, this wasted time and inefficient use of facilities is an unacceptable situation.

It is anticipated that the model package prepared in this study will serve as a guide for other Florida community colleges. The individual regression analyses and correlation analyses should facilitate predicting how well recent high school graduates will perform in their respective business courses pursued during the first semester of attendance at the college.

Independent variables used in this study are available to all community college counselors in Florida and thus the model being developed could be used throughout the state.

BACKGROUND OF THE PROBLEM

The problem of a high attrition rate in business administration courses has been a continuing source of concern to administrators and faculty members of the business division at Brevard Community College. A study relating to student withdrawal rate and class size in basic accounting and business statistics in Brevard Community College was conducted by Beninate and Boutelle (1973). Findings revealed that there was no significant difference in withdrawal with class size the independent variable. Another study was conducted by Boutelle (1975) to determine if a basic accounting class could be successfully taught with programmed materials in a regular classroom setting. Findings indicated that there was no significant difference in progress made by students taught under the traditional lecture-discussion method and those taught with the assistance of programmed materials.

No attempt was made to analyze in detail the reason for attrition of those students from the aforementioned sixty-one business classes surveyed. However, a general analysis suggests that some students failed to attend class after the first day or first few class sessions and were administratively withdrawn by their respective instructors. Others withdrew for various stated reasons such as medical, moving from the area, or losing their jobs. Many others withdrew without stating a reason on the withdrawal form.

Based upon eight years experience at Brevard Community College, the registrar reported that many students enter on the withdrawal form an incorrect reason for withdrawing from a class. For example, he stated that some may list "moving from the area" as the reason for withdrawal when they actually never do move. The registrar's conclusion was that little reliance can be placed on the reasons given by the students for withdrawing from individual classes. Therefore, determining attrition causes based upon explanantions entered on the student withdrawal form appears to have limited value.

One of the most perplexing issues facing higher education and the junior colleges in particular is the high attrition rate of their clientele. Astin (1972:13-14) recently completed a nationwide study of dropouts conducted for the American Council of Education. He concluded that ". . .the unfilled expectations are the rule rather than the exception among two-year college students." And, he adds later, that the same is true for students at four-year colleges. Cohen and Brawer (1970) reflected that one of the most perplexing issues facing higher education and the junior colleges in particular is the high attrition rate of their clientele. They reported that attrition is of national concern and that it has averaged nearly fifty percent for as long as studies have been conducted. Greenberg (1972) conducted a similar study in attempting to predict who will withdraw during their first semester of attendance at Miami-Dade Junior College.

The high attrition rate of students who enroll in institutions of higher education has raised a serious question concerning the responsibility of higher educational institutions to increase the probability of success for these students. McFaddin (1971) attempts to deal with one of these responsibilities, that of guidance, through the development of a predictive model for academic success. The findings indicate that the probability of a student achieving academic success at the University of Florida might be directly related to his choice of college enrollment within the university. People who counsel students in their academic lives need to be aware of such possible different outcomes between the colleges within the institution. Those who counsel students should be cognizant that a predictive model is a tool. Professional knowledge, judgement, and experience cannot be replaced by a predictive model for academic success but can only be aided. That there was need for another prediction study can be questioned and the answer is found in the shift of grading practices and the populations attracted to the community colleges and the need for local validation and evaluation research efforts in all phases of community college processes.

SUMMARY AND STATEMENT OF THE PROBLEM

The purpose of this research was to develop a model for predicting success in Florida community college business courses for recent high school graduates. During the process of developing the predictive computations at Brevard Community College a detailed outline of the various procedures taken and methods used in the development sequence were prepared. A model package has been developed which may be applicable to other Florida community colleges.

Procedures include analyses of test scores and academic background of Brevard County high school students entering their first semester business courses at Brevard Community College in August 1973 and 1974 and measurement of the academic success which these students achieved in their business courses. Based upon these studies, predictive computations have been developed which will result in more effective placement of students in business courses. This additional information and effective placement of students could result in a higher success ratio in business courses and a consequent reduction in the current attrition rate.

ASSUMPTIONS

The following assumptions are made relative to the development of this study:

1. The population chosen consisted of all 1973 and 1974 Brevard County high school graduates entering certain first semester business courses in August, 1973 and

August, 1974, respectively. This group is representative of the average student group for any term and is considered as a sample of the average high school graduate who enters first semester business courses at BCC.

2. Instructor differences do not affect the success rate in these courses.
3. The results of this study conducted at Brevard Community College may be applicable to other junior/community colleges in Florida. Independent variables used include scores made on the Florida state-wide twelfth grade placement program and thus the model developed would be applicable only to Florida high school graduates.

LIMITATIONS

1. Brevard County has a population heavily oriented toward the space industry and the results of the regression analyses relative to this institution may not be applicable to other populations of students.
2. Motivation of the student was not considered and there was no indication of whether individual course selections were by choice or as a result of program requirements.
3. Since the Florida state-wide tests were used, the model developed is limited to use by Florida residents who have completed this series of tests.

4. The model developed was based upon a sample of high school graduates who enrolled in BCC the term following graduation, thus many student categories were not included.

5. All students who were enrolled in the selected business courses in the semester following graduation from high school were included in the original sample, even though they may have attended only one class session. Inclusion of these students may have adversely affected the regression equation, thus it was determined that students who did not complete the course would be deleted from the sample and that substitutions would be obtained from similar 1972 graduates from the Brevard County High Schools.

6. The model developed in this project would not be applicable to the "older" prospective student as most of them have not taken the Florida twelfth grade tests. Further, the high school grade point average might not prove to be valid for use as an independent variable. The achievement of these older personnel acquired through experiences encountered in the world outside of the educational institutions, and obtained through the reading of newspapers, magazines and books, can not be measured by grades earned many years ago. The motivation to do now what they had been unable to do in their earlier years probably would result in a false picture if old academic records were to be used as predictor variables

for this category of potential students. Development and selection of other independent variables would be required in such a study in order to insure validity and reliability.

ORGANIZATION OF THE STUDY

Chapter I has presented an introduction to the problem as stated and has provided reasons for the instigation of this research. Chapter II presents a review of the literature relating to the problem and the efforts of others to develop effective predictive instruments. Chapter III contains the steps in the procedures taken in the conduct of this research. Chapter IV presents the results of the procedures followed in this study, and Chapter V presents the summary and the findings of the study. Implications of the findings, a strategy for implementation, and recommendations for further study are also presented in Chapter V. The Appendix contains a model which can be used by other Florida community colleges to develop prediction instruments which are applicable to their own institutions.

CHAPTER II

REVIEW OF THE LITERATURE AND STATEMENT OF RESEARCH QUESTIONS

The basic purpose of this research was to develop a model for predicting success in Florida Community College business courses for recent high school graduates. The background of the study indicated several reasons why such a model was considered necessary. A review of the literature presents related efforts of other individuals and institutions in the subject area under study.

A computer dissertation search conducted by Xerox University Microfilms revealed many instances of research in the area of prediction studies. There were none in the immediate subject area of this research.

A comprehensive literature search was conducted by the North Carolina Science and Technology Research Center. The Resources Center at Brevard Community College also conducted a thorough search of the literature which included the utilization of Florida ERIC titles and an inter-institutional library search. These revealed several works in the prediction of success areas of study. Many of the studies uncovered had at least some peripheral relationship to this research.

The review of literature presented here is in a structured format that provides related answers to the research questions formulated for this study. Answers to these questions follow naturally toward the solutions of the major issue which prompted this research effort. The major issue was: What steps can be taken to help the counselors do a more effective job in helping students to select their programs of study, thereby assisting in reducing the current attrition rate in selected business course areas in Florida community colleges?

ATTRITION AND RECRUITING

The research literature concerned with college attrition has typically identified distinguishing characteristics of dropouts and persisters, rather than predicted attrition, per se. Recently researchers have tended to sub-categorize dropouts to account for transfers and students who withdrew in good or poor academic standing. Several variables have been identified as being related to attrition -- non-intellective factors such as satisfaction with the institution, its programs, high school performance and achievement/aptitude test scores. As with the prediction of academic achievement, the literature on attrition is replete with studies investigating past performance and test scores. A number of reports considered the relationship between attrition and high school grades and achievement/aptitude test scores; many studies compared dropouts and persisters on these variables. Astin (1972) revealed that a comprehensive national profile developed from data collected at 251 representative colleges and universities revealed that high school grades and scores on standard tests of academic ability, singly or in combination, were the best predictors of college persistence.

If it cannot be stated with accuracy that a student will not succeed in a given course, there is no real justification to the student for not permitting him to attempt it. This becomes particularly important where course credit is involved. A student who could have successfully completed a credit course is severly penalized by being coerced into taking a non-credit and unrelated course instead. Reese (1971) explains, "Loss of credit means not only extra outlay of cash for additional courses but also frequently a delay of a year or more before completion of the degree. This delay may cause a loss of thousands of dollars (first year's earnings) and a year or more of service credit toward retirement."

Contrary to past trends, there is a growing interest among educators in finding ways to "beat the system." It is argued that the goal of the community college should be to provide opportunities for students to overcome deficiencies suggested by high school grades and test scores. This argument is well stated by Hendrix (1968).

For comprehensive community colleges, there is no philosophical reason to expect or desire a high degree of predictability of grades and grade point average from ability measures. For example, if a high multiple correlation coefficient indicates a strong relationship between ACT scores and grade average, this could be interpreted to mean that grades are largely determined by the ability "in-puts" the students bring to the college. In other words, the "out-puts" of the college are largely determined by the nature of the "in-puts" and not by what happens to students after they enter the institution. If a weak relationship between ability measure and grade point average is indicated by a low correlation coefficient, this could be interpreted to mean that students of widely varying abilities are channeled into programs where success, as indicated by grades and grade point averages, is predetermined only to a small extent by their entering ability levels. This could mean the college is providing appropriate programs for students of different ability levels.

Landini (1972) summarized the results of his study relating to the evaluation of the recruiting efforts for a local community college. In educational planning, spiraling costs and decreasing revenues are a major concern, and it is no longer good enough to depend on that individual gut reaction to how good a job a school is doing for the community, especially the junior college with its open-door policy and opportunities to develop alternative life styles. A universal classification scheme on cultural variables for which data are available, if valid, would provide a means for identifying areas where intensive junior and community college recruitment is needed. This would hopefully provide a means of salvaging a great deal of wasted human resources represented in the high numbers of potential students who do not walk through that "open door" by actively recruiting them and offering them meaningful educational programs matched to their individual abilities and capabilities.

PREDICTING COLLEGE ACHIEVEMENT

1. Independent variables considered and results obtained.

a. High school grades and achievement/aptitude test scores. The research concerned with prediction of college achievement has considered many single and multiple predictor variables. The literature is replete with reports studying the predictive validity of high school grades and achievement/aptitude test scores. Measures of reading ability, and more recently, biographical data, are also factors commonly studied for predictive purposes. While many factors are important, it appears that for the majority of students applying for college entrance,

> the high school average (or class rank) is ... the best single predictor of college grades; aptitude test scores ... and appreciably to the accuracy of that prediction, and scores on tests in specific subject-matter areas add only a modest amount of predictive power to the combination of high school grades and aptitude test scores. (Commission on Tests, 1970:18)

Morgan (1971) and Miller (1970) indicate that the majority of data on prediction of attrition has suggested that students who persist, transfer, drop out, or flunk out can be discriminated on the basis of high school grades (or rank) and/or standardized test scores. The results were not unexpected. Since college performance, that is, grade point average (GPA) is a major reason for withdrawal and high school grades and test performances are relatively reliable predictors of college achievement, it follows that these measures should be able to distinguish between high and low achieving students who withdraw or persist. In conclusion, (Miller, 1971) college GPA, high school grades, and achievement/aptitude test scores have been identified as variables strongly related to college attrition, "but no one or two neatly packaged predictors of attrition have been found."

A study of the use of high school records in predicting student success in trade, technical, and business schools (Livers, 1964) found that the most consistent predictors of performance in the various trade and technical training courses were academic factors (e.g. high school GPA and rank in class), while the best predictor of employer ratings of on-the-job performance was found to be high school GPA. An additional conclusion by Stock and Pratzner (1969:25) indicates that success in trade and technical schools can be predicted better than success on-the-job when the predictor variables used are student characteristics from high school records.

Karp (1966), in a study of first year private business school students, investigated the relationship between selected prognostic measures (aptitudes, abilities, and high school class rank) and first year academic success. He found that high school rank was the most important academic predictor (R = .63). A multiple correlation equation utilizing seven independent variables resulted in substantial predictive value (R = .63); the top three variables (high school rank, verbal reasoning, and Iowa Standard Reading Scores) of the seven independent variables yielded a multiple correlation of R = .61

(Stock and Pratzner (1969:25).

Gell and Bleil (1971) conducted a study of freshmen students entering Montgomery College in the Fall 1969. The purpose of their study was to analyze the relationship between high school grades, ACT scores, and first semester college grades. When high school grades and ACT scores were correlated with first semester college grades, the greatest predictive accuracy was obtained for Math 112 and Biology 101. While English 101 and History 103 produced positive correlations useful for prediction purposes, these indices cannot be considered strong or highly efficient. Except for Biology 101, ACT scores proved to be better predictors of academic success in college than high school grades. In no subject area do the college's predictors reach the level of efficiency enjoyed by over fifty percent of the schools involved in ACT's Standard Research Service. Their findings indicate that high school grades and ACT scores are useful in counseling entering students but that they should not be used as the only criteria. When a student's high school grades and test scores are divergent, the counselor could advisedly weigh one more than the other depending upon the goal of the student. So long as the relationship between basic language skills (as measured by ACT) and English 101 grades remain weak, the policy of urging students with low ACT scores to enroll in non-credit review programs does not appear to be justified.

b. Socio-economic level - economically disadvantaged, and minority - race, sex, and marital status. Among the factors related to academic achievement and attrition include socio-economic level - economically disadvantaged, minority - race, sex, and marital status. It appears that socio-economic level is directly related to college accessibility - low income students are less likely to attend college. Generally, the research literature has shown that low socio-economic level is associated with lower general achievement/aptitude test scores, variable college success, and a higher drop-out rate. (Commission on Tests, 1970:10).

Minority - race access to high education has been limited indirectly by the use of traditional selection criteria, especially standardized test scores. (Commission on Tests, 1970:10). Bowles and DeCosta (1971:185) state,

> Such tests are empirically established measures for the prediction of academic performance, though they are often assailed as carrying a built-in cultural bias. The charge of bias is true in that the tests are related to dominant, i.e. white, cultural patterns.

But it is also true that these tests generally tend to accurately measure a person's ability to do quality work in college. In other words, culturally biased or not, the tests are all too accurate in their measurement of any handicap with respect to college preparation, (Jaffe, Adams, and Myers 1968:252).

On the basis of the research literature, race should be considered when attempting to predict success at college. Separate regression equations for Blacks and Whites have been recommended to enhance the validity of predictions made from standardized test scores. (Commission on Tests 1970:13).

Sex differences exist in college attendance, academic prediction, and college success. Low ability women find it more difficult to enter institutions of higher education. Women in college, in terms of academic average, tend to do better than men but this is probably the result of selection procedures. Women also tend to have higher dropout rates. On the basis of the research literature, predictions of achievement and attrition may be enhanced when sex is taken into consideration (Commission on Tests 1970:17, 18). Due to the open door policy in Brevard Community College, entrance is not restrictive to the low achiever or low ability individual, regardless of sex or race.

Marital status does not seem to have a significant effect upon achievement but is storngly related to college attendance and attrition. Marriage is negatively associated with college attendance, especially for women and more so for Whites than Blacks. Married students are also more apt to drop out, but this may be associated with financial and emotional difficulties (Commission on Tests 1970:21). Due to the small number of high school students who become married between graduation from high school in June and enrollment in BCC in August, marital status will not be included as one of the independent variables in this study.

c. School related factors. Stock and Pratzner (1969:26) report a study conducted at the Institute of Technology, University of Minnesota which investigated change in predictive efficiency by introducing school-related factors into the regression equation containing the IT Math Test and high school rank. The school-related factors were size of school (50 or less, 51 to 100, 101 or more), and the kind of school (urban, suburban, private). Regression equations designed specifically for urban and private groups consistently predicted GPA with greater accuracy. It was concluded that students entering the Institute of Technology program from urban and private schools were sufficiently different from other groups of students investigated, in terms of academic predictability, to warrant use of regression equations.

d. Test Scores. Florida State-Wide Twelfth Grade Testing Program. All seniors in the Florida school system participate in the Florida state-wide twelfth grade testing program. The results are contained in an annual report published by the University of Florida. Form VRT of the test was prepared for the Florida testing program in the fall of 1973 by the Educational Testing Service, Princeton, New Jersey. Percentile norms were calculated by the University of Florida (1973) using all seniors who completed all five basic tests in the battery: (1) Aptitude, (2) English, (3) Social Studies, (4) Natural Sciences, and (5) Mathematics. A total (sum of the five basic percentiles) was also computed. The mean, standard deviation, reliability coefficient, standard error or measurement, percentile ranks, and standard scores are computed. State-wide norms, 1973, for 78,467 participants revealed reliability coefficients ranging from .89 to .94 for the five basic subject areas. Greenberg (1973) attempted to predict who will withdraw during their first semester attendance at Miami-Dade Junior College, South Campus, Miami, Florida. Background data were augmented with high school test data and parental occupational information.

Two decks of data were key punched, one for "persistors" (i.e. those who completed their first semester with at least one course of credit) and one for "withdrawers" (i.e. those who left during their first semester with no credits earned). The technique used for data treatment was discriminant analysis, the purpose of which was to identify those variables which significantly differentiate one group from the other. Variables so identified would be the ones to be used in a prediction equation.

The total array of information collected for each student was as follows:

(1) Full-time or part-time student
(2) Sex
(3) Occupation of parent
(4) Florida Twelfth Grade Aptitude
(5) Florida Twelfth Grade English
(6) Florida Twelfth Grade Social Studies
(7) Florida Twelfth Grade Natural Science
(8) Florida Twelfth Grade Mathematics
(9) Florida Twelfth Grade Total
(10) Florida Twelfth Grade Aptitude Verbal
(11) Florida Twelfth Grade Aptitude Quantitative
(12) Florida Twelfth Grade Reading Index
(13) High School Grade Point Average

(14) High School Rank

(15) Stanford Achievement Reading - High School

(16) Stanford Achievement Mathematics - High School

(17) Race (coded for "White", "Black" and "Other")

All of the above data were not available for all students, which resulted in the requirement for several "runs" or analyses, each containing a different combination of variables. Greenberg referred to some of the limitations in his study, including the fact that data were available on only half of those who withdrew and the small number of Blacks included (5 withdrawers and 17 persisters). He found the variable Social Studies Florida Twelfth Grade Score the most significant in discriminating between persisters and withdrawers. Part-time and full-time status as well as race were also significant factors. High school rank, excluding the Florida Twelfth Grade scores, entered significantly with the student having the better high school standing more likely to persist than one with a lower standing. Greenberg concluded that he had generalized a prediction equation although its use would result in the improper labeling of many students. The value of utilizing this tool must be weighed against the consideration that if it were applied to the entire population of newly entering students several hundred who would actually "persist" would be labeled as potential drop-outs. There appears to be a need to carefully explore the benefits and costs of this method particularly as they relate to the goals of the college. Greenberg (1972:12) Cole (1969) presented information gathered from 100 colleges and universities which indicated that high school subject-area grades were more related to college subject-area grades than were American College Test (ACT) scores, although the ACT scores remained closely related to overall academic success. High School grades and aptitude test scores. In 1970, the Commission on Tests, stated that:

> for a large and heterogeneous group of freshmen, the combination of high school grades and aptitude test scores will usually predict about two-thirds of the freshmen grade-point averages within half a letter grade or so.

Lynch (1970:4) developed a model in the Wayne Community College for predicting success in technical occupational programs. Objectives of the research were:

1. To design, develop, and operate an "efficient program of occupational and educational guidance within Wayne County through the Goldsboro City Schools, Wayne County Schools, and Wayne Community College."
2. The development of a model to predict success in

community college programs and especially in occupational programs. The admissions procedures developed by the Student Personnel Services at the college include:

(a) the accumulation of information on a student's previous academic experiences.
(b) recommendations from teachers and counselors.
(c) placement tests of basic skills learned.
(d) interviews with counselors and college staff.
(e) additional testing as desired.

The rationale for procurement of this information is to enable the student to be placed in a program in which he is interested and in which his abilities indicated the likelihood of success. In spite of these efforts some students succeed and others do not. In this study success is measured by successful completion of the program. It was felt that by studying the information available on students who have succeeded and on students who are near completion, a pattern of scores and skills would emerge. By comparing a potential student's record with this pattern a counselor could predict the level of success this student might experience. Instruments used for students enrolled at Wayne Community College (Greensboro, N.C.) were the School and College Aptitude Test, and the Otis-Lennon J., Advanced Test. Based upon her study she made an overall general conclusion that prediction will be accurate in 60 cases out of 100. This, she concluded, assumes a normal dis-ribution of motivational and other factors which cause students to appear to perform at a higher level than they should.

Based upon results of her studies relative to prediction of success, she made the following recommendations:

(1) A preparatory program of study for those students who do not meet the criteria of their curriculum. Each department will have to prescribe its own formula for aiding these students.

(2) Some students need to be exposed to a basic preparatory program while others will have only limited weaknesses which may be removed without too much difficulty.

(3) In dealing with the student who is generally weak there appear to be two basic alternatives available, (1) a term or more of preparatory study in reading, English, mathematics, and physical science, or (2) assigning the student a reduced load. Care must be taken not to overload the student during his first year.

(4) Establish a criterion for successful completion of the preparatory program. The most appropriate criterion would be a retesting with another form of the tests used in the admissions battery.

(5) That applicants with minor academic weaknesses might be accepted tentatively on the condition that they resolve their academic weaknesses.

The Toronto Board of Education (1973) conducted a review of the Differential Aptitude Tests (DAT) and a number of other aptitude tests, including the Flanagan Aptitude Classification Tests, the Holsinger-Crowder Uni-Factor Tests, Revised Minnesota Paper Form Board Tests, and the Minnesota Clerical Test. Their results suggest that aptitude tests have been useful instruments in predicting general scholastic aptitudes but have not been as successful in predicting technical aptitudes. Possible reasons for this may be that (1) a student's high interest does not necessarily indicate a high aptitude, and (2) the inability to measure every aspect of the achievement process. It was concluded that further research is necessary for aptitudes to be identified and measured more accurately. The Board suggested that (1) present multi-factor batteries do not adequately differentiate aptitudes, (2) adequate guidance will depend on supplemental information, and (3) student motivation requires more attention and measurement.

e. Prediction that all students will receive a grade point average of 2.00 or better. Based upon their study of prospective and present students in the San Diego Junior Colleges (California) relative to their vocational programs, Heinkel and Peerson's (1971:5-7) study clearly indicated that the American College Test scores do not significantly improve the validity of predictive expressions based exclusively on non-test variables. The study also indicates that expressions developed from the twelve predictor variables (including American College Test scores and high school grades) have no greater accuracy than the simple prediction: all students will receive a grade point average of 2.00 or better. They continue by stating that for all practical purposes, there is no relationship between the test scores and grades. It is ironic that these are the two test scores most commonly used for placement purposes. The authors firmly believe that any individual who is denied or even discourage from enrolling on the basis of predictive expressions should question strongly the basis on which such a decision is made. The potential harm and discouragement that probably occur with the very students that need help and encouragement is incompatible with the concept of the "open door" community college.

f. Educational and Socio-economic information. Malone (1965) conducted a study which used educational and socio-economic information about students to predict success in training. Malone's study was completed by post-high school students, and items used as independent variables consisted of the following: high school grade point average, intelligence test scores, rank in class, occupations for father and mother, educational levels of father and mother, and a list of high school subjects and grades. As a result of his study, Malone (1965: 113-148) concluded:

(1) Academic factors, principally high school grade point average, rank in high school class, and grade point averages in selected high school subject areas were the most consistent single predictors of success.

(2) Socio-economic factors in general were not significant as predictors of success in training. The variables of age, vocational maturity, and a few work values did correlate significantly with the criterion in some cases.

(3) Multiple correlations, using instructor ratings of success as the dependent variable, consistently showed student characteristics such as grade point averages (composite and subject area), rank in high school class and type of curriculum pursued in high school to be among the highest predictors, both when used alone and when combined with Dailey Vocational Test scores.

g. Self-made academic predictions. Biggs and Johnson (1972) conducted a study concerned with identifying and measuring self-made academic predictions of entering junior college freshmen and with relating these predictions to past and future academic performance, as well as to measures of scholastic aptitude. Self-made academic predictions and aspirations levels of entering junior college students would seem to be related. A student's prediction about how well he can expect to do in a junior college probably influences his decision to enter that college, his persistence, and his level of academic achievement. Also, counselors and advisors of junior college freshmen need to have accurate information about their clients' academic predictions, and their beliefs about their own ability relative to the ability of other students. Both Levin (1965) and Brim (1965), after comprehensive reviews of the literature, concluded that a person's belief about his ability strongly affects his goals and the quality of academic performance.

The College Opinion Survey (COS) which measures self-made academic predictions was used by Biggs and Johnson (1972) in their study using 787 entering freshmen at North Hennepin State Junior College, Brooklyn Park, Minnesota. Eight of the sixteen items on the COS were drawn from the General Self-Concept of Ability to Learn Scale (Brookover, 1962). The remaining eight items were drawn from the Importance of Achieving Higher Grades than Others Scale (Brookover, 1965). Past academic performance, future academic performance, and scholastic aptitude were related to COS scores. Findings revealed that all three measures of self-made academic predictions in the COS have small but significant correlations with future predictions. The findings further suggested that students who stress the importance of grades may do so regardless of ability. They also examined the independent contribution of self-made academic predictions to the actuarial prediction of future academic performance. Their findings revealed that they were able to predict future grades more accurately for females than males. The inclusion of self-made predictions to the standard multiple correlation of past performance and academic aptitude with future performance increased the correlations somewhat for both males and females.

Biggs and Johnson (1972) concluded that the results of their study showed that entering junior college students' self-made predictions based on ability and achievement comparisons with others and estimates of future performance are related to past performance, academic aptitude, and future performance. Self-made predictions based on feelings about the importance of grades are not related to scholastic aptitude but are related somewhat to future academic performance. Self-made predictions do influence future performance. Junior College counselors can assist students to reevaluate how the social comparison process has led to the development of certain attitudes about their relative ability and performance in the dynamics of their academic achievement.

The placement office at BCC conducted a followup study of its 1973 and 1974 graduates. There were 499 (28%) responses out of a total of 1768 questionnaires mailed. In this group of 499 responders 261 graduates were attending four-year senior institutions. Answers to one of the questions, "How do you rate your performance at the institution you are now attending?" appeared to substantiate the findings of Biggs and Johnson (1972). Categories of student response revealed that sixty-two percent of these students earned grades, "about the same as I expected" while 16% received grades, "Higher than I expected," and 5% were awarded grades, "Much higher than I expected." Conversely, only 14% of the students earned grades, "Lower than I expected," and 3% received grades, "Much lower than I expected." Smith (1975).

h. Class Size. The results of the research reported here indicate that student completion is affected by class size. For 195 classes characterized as small (0-20 students) student completion was significantly lower than in day classes overall. That this result could not be obtained by chance alone is guaranteed by a $\underline{z}$ score of 6.65--well beyond the 99% confidence level. Interestingly, classes 20-30, 30-40 or over 40 students did not have completion ratios which varied from the overall average. For many observers this result is at variance with their felt intuitions regarding class size and student success. Recent educational research however has continually failed to find any strong correlation between class size and student learning or student success. Galvin (1973) reports that Chrisp & Aven in their study on mathematics instruction in college found significant correlation between class size and student learning, while Hoover, in his study found that instructor's attitude was more important to student success than class size.

i. Other. The predictability of success appears to be much greater in some vocational areas than others: e.g., medians obtained in shorthand and business education represents the upper extreme, while those obtained in auto mechanics, carpentry, and electricity represent the lower extreme. It has been stated by Prediger, *et al*. (1968: 137-145) that "...multiple regression techniques could result in appreciable gains in predictability in a given setting."

EFFICIENCY OF PREDICTIONS

1. Validity Study Report. Gourley (1971) conducted a study of 539 community college students to determine the best predictor among the data available to counselors to predict overall grade point average and English GPA for specific English courses. Predictor variables included: test scores on the (1) CGP, (2) high school rank in class (HSRK), (3) SCAT-Verbal, (4) SCAT-Quantitative, (5) SCAT - Total, (6) Differential Aptitude Test, (7) California Test of Mental Maturity, and (8) the average of self-reported grades in their last two high school English courses.

Results of the above investigation indicated that for all students the combination of high school rank, CGP Sentences score and CGP Math Score would predict overall GPA with a multiple correlation of .438 with a standard error of estimate .89. Proportional contribution of predictors was Sentences .37, Math .23, Verbal .01, and HSRK .39. Gourley further hypothesized that it would seem that high school rank represents, in addition to learning potential and skill, factors not measured by other predictors and would suggest further study and investigation in possible non-intellective factors reflected in high school rank.

2. Prediction Studies based on ACT. A study of predictor variables by Reed (1968) used a combination of high school grades (H) and ACT subtest scores (T), and optimally weighted index referrred to as the T-H (Test - High School) Index. The T-H Index predicted both the College Grade Point Average (R - .56, SE - .73) and the Social Studies grades (R - .60, SE - .78) better than any other single score. The high school grade average predicted the College overall grade point average better than did the ACT subtest scores, or a single high school subject. The ACT composite predicted the college social studies grade better than did any one predictor. He reported that correlations and standard errors of measurement for the data at Central Virginia Community College were quite similar to

those at comparable institutions.

3. Florida State-Wide Twelfth Grade Testing Program. Results of the scores on the Florida state-wide twelfth grade testing program are available in student records maintained in the BCC Registrar's Office and in the published annual reports which are located in the various counselor's offices. These tests are taken by all Florida graduating high school seniors and are considered excellent tests of achievement. While these tests in themselves are considered accurate, this study will determine how reliable these scores are as predictors of success in first semester business courses taken at BCC. State-wide norms were computed for tests taken in the fall of 1973. The mean, standard deviation, reliability, and standard error were included in the computations for each of the five basic subject areas.

SUMMARY AND STATEMENT OF RESEARCH QUESTIONS

The literature review has revealed many instances of attempts to predict achievement of students enrolling in college courses. This review revealed that many different independent variables can be used to predict student success. The reliability of these independent variables as predictors of college grades has been examined. Review of the literature indicated that predicting college student success is feasible. Based upon these findings there appears to be ample justification for attempting to predict student success in Florida community college first semester business courses for recent high school graduates.

Major Issue. This study is concerned with one of the major issues of concern in Brevard Community College. What steps can be taken to help the counselors do a more effective job in helping students to select their programs of study, thereby assisting in reducing the current attrition rate?

Research Questions. Resolution of the major issue being addressed in this research was dependent upon findings to the following research questions.

1. Is there a well established relationship between entry variables, such as 12th Grade GPA, Florida state-wide twelfth grade placement test scores, and the grades a prospective student will earn in his first semester business courses at BCC?
2. Are there records available to BCC counselors which can be used as a basis for computations which will predict how well prospective students will perform in the first semester business courses?
3. Can a simple table, equation, or formula be developed for use by counselors and Business Division instructors which will make use of available data enabling them to predict how well a prospective student will perform in his first semester business courses?
4. How reliable is the prediction instrument established in the preceding paragraph?
5. If the first three of the above questions are resolved in the

affirmative and a reliable prediction instrument is developed, can a model package be assembled for use by other Florida community colleges?

CHAPTER III

PROCEDURES

DESCRIPTION OF THE FIELD SITUATION IN WHICH THE DATA WAS COLLECTED

Brevard Community College, a multi-campus two-year college is located in the center of the Space Industry in Brevard County which extends for some seventy-five miles from North to South. The county contains eleven high schools: nine public high schools; the Florida Air Academy, a private school; and the Central Catholic high school. Wattenbarger (1973) reported that approximately 35% of the graduates from these high schools in 1972 and 1973 attended BCC. Current records reveal that about the same percentage of the 1974 graduates from these high schools attended BCC. The purpose of this investigation was to develop a model for predicting success for these high school graduates who enrolled in business courses during their first semester of attendance at BCC. No such prediction instrument was previously available for use by college counselors and instructors of business administration courses. The relatively high attrition rate in business courses which are required for completion of an Associate of Arts or Associate of Science degree program indicated a definite need for such an instrument.

DESCRIPTION OF THE INDIVIDUALS WHO SERVED AS THE DATA SOURCE

All of the 1973 and 1974 Brevard County high school graduates who enrolled in certain business courses during their first semester in BCC were considered as the sample for this discriminate prediction study. The business courses considered for discriminate prediction purposes were Accounting I, Introduction to Business, Principles of Marketing, and Principles of Economics I. Some of these high school graduates were enrolled in other business courses, such as Business and Economic Statistics, and Principles of Management. However, the number enrolled in these other classes was too small for conducting statistical analyses and computing regression analyses.

The use of the four business courses selected was considered sufficient for the development of a model package which could be used for the development of similar prediction instruments in other Florida community colleges. This model, developed for discriminate prediction purposes, could be used for the development of prediction instruments in other subjects.

OVERALL DESIGN FOR ANSWERING RESEARCH QUESTIONS

1. Obtaining permission and support for the conduct of the study. Permission to conduct this study was obtained from the vice president of instruction, BCC. Support of this office was viewed as essential. It was agreed that the study, devoted to the development of a model package, could produce a prediction instrument which would be extremely useful to counselors and business administration instructors in performing their normal counseling duties. Counselors, when interviewing students during their annual visitations to the various high schools throughout the county, might find these instruments particularly useful. This recruiting program has been a

valuable asset to the college as well as being helpful to the high school students and their high school counselors. It was hoped this study would result in better assignment of students in their initial course selections, thereby resulting in a reduced attrition rate. The support of the vice president, plus that of the registrar, aided basic data collection.

2. How the data was collected. Collection of data in this research involved serveral procedures. A literature search of the subject area was conducted and information obtained on dissertations related to the general subject area of prediction studies. This was accomplished with the aid of computer assisted searches performed by professional organizations engaged in this type of activity. Xerox University Microfilms, Ann Arbor, Michigan, conducted the comprehensive dissertation query service in which thirty-two dissertations relating to predicting academic success were found and studied. The North Carolina Science and Technological Research Center, Research Triangle Park, North Carolina, provided library search services relating to grade prediction in community college business courses. Appropriate materials from these sources were included in the review of the literature.
The sample population was drawn from Brevard Community College students. All 1973 and 1974 graduates from the eleven high schools located in Brevard County, who entered BCC the term

following graduation and who enrolled in specific business courses were included in the sample population. Data pertaining to this sample were obtained from student records located in the registrar's office, as indicated in the chronology of activities. BCC has three campus locations but all of the official student records are maintained in the registrar's office which is located on the Cocoa Campus.

Other data sources included the study of statistical measures and procedures which could appropriately be used in making predictive computations and determination of the validity and reliability of the predictions.

A computer terminal at the college was available to compute the correlation and multiple regression analyses and other essential statistical computations. The volume of required computations ruled out the manipulation of figures by manual methods, even with the use of electronic calculators.

3. Chronology of activities. The following reflects the chronology of activities during the conduct of this study. Many of these activities or steps may be required of personnel in other community colleges who desire to use this model in developing predictions of student success for use in their own institutions.

   a. The director of the Data Services Center, BCC, was contacted to determine what data could be acquired from his office in order to complete the proposed discriminate prediction study. Data in the computer files at that time was made available.

As a result of this discussion, the Data Center prepared a roster (Table 1) of all of the 1973 Brevard County high school graduates who enrolled in BCC in August, 1973, with "business" indicated as the intended major program. There were 141 students listed on this roster. A similar roster containing 173 names was prepared for the 1974 graduates who enrolled in BCC in August, 1974. These rosters contained many items of specific information, including student number, sex, race, year of birth, identification of campus location, and program of intended major.

TABLE 1

1974 BREVARD COUNTY HIGH SCHOOL GRADUATES
ENROLLED IN BREVARD COMMUNITY COLLEGE IN AUGUST, 1974
WHO INDICATED "BUSINESS" AS THEIR MAJOR PROGRAM

NAME	STUDENT NUMBER	YEAR OF BIRTH	SEX*	RACE*	HIGH* SCHOOL	MAJOR* PROGRAM
Adams, Henry	74-13346-1	55	1	3	01	103
Jones, John	74-12345-1	56	1	5	16	102

* Numerical Codes are used to represent these items.

Note: Student names are fictitious.

b. The registrar, BCC, who was responsible for developing, processing and maintaining all student records was contacted. Master class schedules for all students were made available. However, the class rolls contained in the master class schedules were listed in alphabetical sequence whereas the rosters prepared by the Data Center were listed in numerical sequence by student number. Thus, the Data Center rosters had to be rearranged in alphabetical sequence by a manual process due to the effort that would have been required at the time to sort them on the computer.

c. The two alphabetical rosters were compared with the master class schedules to determine the business courses in which the sample students had been enrolled and the grade earned in each. Tally sheets were prepared to determine the number of students enrolled in each of the business courses. This revealed that sixty-seven of the one hundred forty-one 1973 graduates were enrolled in ninety-one business courses. The 1974 roster of one hundred seventy-three students contained ninety-eight students who were enrolled in a total of one hundred forty-six business courses. The various classes were conducted on each of the three campus locations of the multi-campus community college. Table 2 indicates the numbers and the business classes in which these students were enrolled. Some students were enrolled in other business courses such as Business and Economic Statistics, and Principles of Management, but the number of these freshmen students was too small for making valid statistical computations.

TABLE 2

BREVARD COUNTY HIGH SCHOOL GRADUATES (1973 & 1974)
ENROLLED IN BUSINESS COURSES AT BREVARD COMMUNITY COLLEGE

COLLEGE COURSE	1973 HIGH SCHOOL GRADUATE	1974 HIGH SCHOOL GRADUATE	TOTAL
Accounting I	11	30	31
Principles of Economics	11	30	41
Principles of Marketing	11	24	35
Introduction to Business	58	72	130
TOTALS	91	146	237

d. It was determined that the sample number of students in Introduction to Business classes would be reduced to fifty. This decision was based on the consideration that the number of students in the three other business courses being considered was less than fifty and this number was sufficient for performing the necessary statistical computations.

e. Fifty Introduction to Business students to be included in the sample population were selected by use of a random numbers table (Stockton and Clark: 1971). In addition, it was decided that the sample should contain the same percentage of students from each of the 1973 and 1974 classes as was contained in the total population. In those instances where a sample student selected had not taken or completed the Florida twelfth grade tests, a replacement student was selected by continuing use of the random numbers table.

f. Four courses, Accounting I, Principles of Economics, Principles of Marketing, and Introduction to Business were selected for this discriminate prediction study. They were selected since all were required core courses in most of the business programs offered at Brevard Community College. These major programs were: (1) Associate of Arts Degree in Business Administration, (2) Associate of Science Degree in Business Management, with additional options in Banking, Office Administration, and Real Estate, and (3) Associate of Science Degree in Cooperative Distribution and Marketing with an additional option of Hotel - Motel Management.

Accounting I was one of the courses included in this predictive study of "first semester business courses" even though all of the business programs listed it is as a second year requirement. Due to the open door policy, which permits any student to enroll in any particular course for which he has the entry requirements, many entering freshmen enroll in Accounting I, and thus the course was included in this study. Some programs at the college require interviews and are on a selection basis due to the limited number of vacancies in these particular programs, such as the Registered Nurse, the Practical Nurse, and the Cosmetology programs. However, the open door policy is applicable to all business courses in which students have the required prerequisites. No other business courses were selected for discriminate predictions due to the limited number of enrollments in these courses by freshmen students who had just graduated from one of the Brevard County high schools. (Brevard Community College: 1974-41, 56 and 59)

g. Permission was obtained from the vice president for instruction, BCC, and the registrar, to prepare copies of the selected students' high school transcripts for the purpose of obtaining information relative to the senior year grade point average and the percentile scores earned on the Florida state-wide twelfth grade tests. This permission was granted with the provision that students' names would be confidential and not released to anyone. Numbers were assigned to the student records to insure that names were not used and that the data obtained was to be used for statistical purposes only. This requirement was in keeping with the state law pertaining to disclosure of information relative to individual students.

h. Xerox copies of the sample students' high school transcripts were prepared using the file copies of the transcripts which were retained in the students' individual files. Student records in the registrar's office were maintained in student number sequence. Thus, searching for the student records was facilitated by the use of rosters prepared in student number sequence.

i. The variables which would be used in these discriminate prediction studies were determined. The grade earned in the subject for which the predictions were being made became the dependent variable. Five individual test scores were available for use as independent variables as well as a total of the five. Individual scores reflected percentiles earned in: (1) Aptitude (APT), (2) English

Achievement (EH), (3) Social Studies Achievement (SS), (4) Natural Science Achievement (NS), and (5) Mathematics Achievement (MS), and a total of the five individual scores was also listed (TOT).

j. Each sample student's senior high school year grade point average was computed and recorded on the high school transcript. Some of the transcripts contained this information while in the great majority of cases, the grade point average for the senior year had to be computed. Computations were based on the same numbering system as used in the college, i.e., A - 4, B - 3, C - 2, C - 1, and W and F - 0.

k. Separate rosters of sample students were prepared for each of the subjects on which discriminate predictions were to be computed. A form was developed to facilitate entering this data. This form, shown as Table 3, was similar to a multiple column accounting sheet. The grade earned in the subject to which the roster pertained, the senior high school year grade point average, and the percentile ranks awarded on the Florida twelfth grade tests were entered on the individual subject forms. There were some instances in which the Florida twelfth grade test percentile ranks were not entered on the high school transcripts. Those scores were obtained from the annual publication by the

University of Florida of information relative to each year's testing program. (University of Florida: 1973 and 1974) In those instances where a student had not completed the Florida twelfth grade tests, a replacement student was selected from the sample 1972 pool of Brevard County high school graduates.

TABLE 3

SAMPLE STUDENT DATA
ACCOUNTING SAMPLE

NAME	GRADE	SEX	RACE	FLORIDA TWELFTH GRADE TESTS PERCENTILE RANKS						
				APT	EH	SS	NS	MS	TOT	GPA
Adams, Henry	C	1	5	54	38	64	80	56	292	3.00
Bierbaum, Theresa	A	2	3	27	34	59	37	66	223	3.70
Johnson, Theodore	D	1	5	63	62	90	83	25	323	2.58

1. Instructors were contacted to determine which students in the sample had actually completed the course and were awarded a grade of "W" rather than an "F." Students who did not complete the course were deleted from the sample and substitutions were made from the 1972 high school graduates in Brevard County who entered BCC in the fall semester, 1972. This step was considered essential since some

students enrolled in a class and attended only one or two sessions. These students included some who apparently enrolled only for the purpose of receiving Veterans Administration or other financial assistance and benefits. Students who withdrew prior to completion of a course were awarded a "W" grade. Most of the instructors now also award a grade of "W" for those students who otherwise would have been given a grade of "F". Any predictions of grades for students should be based on the assumption that the students will complete the course. Elimination of those students who did not complete the course added to the validity and reliability to the predictions -- a situation demonstrated in a pilot study conducted early in this research effort.

m. Computer programs available through the computer terminal located in the Science Building were analyzed. The programs were listed and described in the Honeywell Series 600 - 6000 Time Sharing Applicatons Library Catalog. Two programs which would perform the necessary statistical computations were selected. STAT 12, a BASIC language program, was selected to compute the mean, standard deviation of each of the variables, and a correlation matrix reflecting cross correlations between each of the variables. MULFIT, a BASIC language program, was selected to compute the multiple regression coefficients, the constant (y intercept), and the index or coefficient of determination -- essentially a multiple correlation.

n. Paper tapes were prepared for use in the computer terminal to compute the means, standard deviations, and a correlation matrix for each of the four samples. The computer program STAT 12 was run and a printout of data was obtained.

o. Each subject matrix was analyzed to determine the two independent variables which would, in each case, provide the most accurate predictions. To identify the best combination of predictor variables, one procedure which is generally used is to select predictors that correlate high with the criterion but correlate low with each other. By reducing the number of independent variables to two, the development of a success prediction table which could be used by counselors and business administration instructors became feasible.

p. Paper tapes were prepared for each subject for use in the computer terminal to compute the constant (y intercept), multiple regression coefficients, and coefficient of determination. The computer program MULFIT was run and a computer printout of data was obtained.

q. The coefficient of correlation and the error of the estimate for each of the four subjects were calculated.

r. Prepared instructions and assembled data which constitute the model package.

DETAILED DESCRIPTION OF STATISTICAL AND COMPUTER PROCEDURES

1. This study attempted to predict how well certain freshmen students would perform in specified business courses. Inasmuch as the project involved the development of a model which could be used in other Florida community colleges, the source data necessarily had to contain only data which would be available to those other institutions. This applicability is limited to Florida because of the utilization of the Florida twelfth grade testing program. However, other community colleges located elsewhere could substitute other test scores. It was contemplated that the results of other similar studies relating to predicting success would be taken into consideration when determining the statistics to be used.
2. The use of multiple regression analysis was judged the most appropriate statistical technique for making the predictions. The variables had previously been determined. The grade earned in the course in which the prediction was being computed became the dependent variable while the senior year grade point average was one of the independent variables. The others included the percentile ranks on each of the five Florida state-wide twelfth grade tests. The total of these five test scores was also used.

3. A computer terminal was available for making computations. The computer was the Honeywell series 600/6000. Programs were available to perform computations required to complete this study. Two programs were selected, (1) STAT 12, a BASIC language program, provided the mean, standard deviation of each variable, and a cross correlation matrix, and (2) MULFIT, a BASIC language program, provided a multiple regression analysis, computing the constant, multiple regression coefficients, and the coefficient of determination.
4. The coefficient of correlation and error of the estimate were computed with the use of a small electronic calculator for each of the four subjects.
5. The assistance of an expert in the use of the BCC computer terminal was obtained to aid in the selection of computer programs which could be used on the computer terminal. After detailed discussions, it was determined that the programs selected should provide the following statistical data for each of the courses in which the prediction studies were to be accomplished in development of the model:
    a. mean of all variables.
    b. standard deviation of all variables.
    c. cross correlation matrixes between variables.
    d. regression analysis equation to include the A values (y intercept) and each of the regression coefficients.
    e. coefficient of determination of the regression equation.

Upon completion of the computer calculations, the resulting regression equation was used with each of the four sample populations, and the standard error of the estimate was computed for each subject. The formula used to compute the standard error of the estimate for each of the multiple regression equations appears below:

$$\widehat{\sigma_{1.23}} = \sqrt{\frac{\sum x_1^2 - a\sum x_1 - b\sum x_1x_2 - c\sum x_1x_3}{n-m}}$$

$\widehat{\sigma_{1.23}}$ - Standard error of the estimate

x_1 - Grade earned (4 point scale A = 4, B = 3, etc.)

x_2 - Percentile score - Florida Twelfth Grade Test

x_3 - Senior year high school grade point average

a - Constant - y intercept

b - Regression coefficient 12.3

c - Regression coefficient 13.2

n - Number of observations

m - Number of constants in regression equation

6. Analysis of the procedures revealed that considerable added manual effort was required to alphabetize the rosters of graduates prepared by the Data Services Center. This effort resulted from the omission of a requirement that separate rosters be prepared in both alphabetical and student number sequence. The additional rosters could be prepared with

minimal effort if the requirement was included in the original request for data.

STATISTICAL PROCEDURES FOR ANSWERING THE RESEARCH QUESTIONS

1. Research question 1 (page 39) (Is there a well established relationship between variables?) The relationship was determined by computation of the cross correlation matrixes by the computer.
2. Research question 3 (page 39) (Can a simple chart, equation, or formula be developed for use by counselors or business division instructors which will make use of available data enabling them to predict how well a prospective student will perform in his first semester business courses?) The cross correlation matrixes were used to reduce the number of independent variables in each subject to two; one of the Florida twelfth grade test scores (percentiles) and the senior year high school grade point average. A multiple regression analysis provided the constant and both regression coefficients as well as the index (coefficient) of determination. Using these data, a prediction chart for each subject was developed.
3. Research question 4 (page 39) (How reliable is the prediction instrument established in the preceding paragraph?) The coefficient of correlation for each subject was obtained by computing the square root of each coefficient of determination. The standard error of the estimate was also computed for each of the subject predictions.

CHAPTER IV

RESULTS AND DISCUSSION

RESULTS

Analysis of grades earned by the sample students as shown in TABLE 4 revealed that thirty-eight percent of them had received a grade of "W", indicating withdrawal from the class. The rate of "W" grades ranged from a high of forty-five percent in Accounting I to a low of twenty-eight percent in the Introduction to Business classes.

After deletion of the students who did not complete the subject course(s) and substitution by replacement, an analysis of grades earned in the respective business courses by the revised sample population is recorded in TABLE 5, and reveals that only three percent of the sample students would have received a grade of "F."

The composition of the sample population was analysed to determine the distribution of students in the various subjects by sex and race. Results of these examinations are shown as TABLES 6 and 7. It can be observed that overall, sixty-four percent of the sample population was male. The female population ranged from a low of twenty-nine percent enrolled in the Principles of Marketing to a high of forty-two percent in Accounting I.

TABLE 4

A COMPARISON OF GRADES EARNED BY SAMPLE STUDENTS IN SELECTED BUSINESS COURSES

Grade	Subject									
	Accounting I		Principles of Marketing		Principles of Economics		Introduction To Business		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
A	5	16	1	3	2	5	9	18	17	11
B	8	26	9	26	6	15	14	28	37	24
C	4	13	10	28	13	32	10	20	37	24
D	0	0	3	3	1	2	3	6	7	4
W or F	14	45	12	34	19	46	14	28	59	38
Totals	31	100%	35	100%	41	100%	50	100%	157	100%

TABLE 5

A COMPARISON OF GRADES EARNED BY SAMPLE STUDENTS IN SELECTED BUSINESS COURSES

(REVISED)

Grade	Subject									
	Accounting I		Principles of Marketing		Principles of Economics		Introduction To Business		Total	
A	4	13	5	14	5	12	7	14	21	13
B	9	29	12	34	10	24	20	40	51	32
C	11	36	14	40	20	49	17	34	62	40
D	6	19	3	9	4	10	6	12	19	12
F	1	3	1	3	2	5	0	0	4	3
Totals	31	100%	35	100%	41	100%	50	100%	157	100%

TABLE 6

A COMPARISON OF SEX OF THE SAMPLE STUDENTS

Sex	Accounting I		Principles of Marketing		Principles of Economics		Introduction To Business		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Male	18	58	25	71	26	63	32	64	101	64
Female	13	42	10	29	15	37	18	36	56	36
Totals	31	100%	35	100%	41	100%	50	100%	157	100%

TABLE 7

A COMPARISON OF RACE OF THE SAMPLE STUDENTS

Race	Accounting I		Principles of Marketing		Principles of Economics		Introduction To Business		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Caucasian	30	97	34	97	40	98	45	90	149	95
Black	1	3	1	3	1	2	4	8	7	4
Other	0	0	0	0	0	0	1	2	1	1
Totals	31	100%	35	100%	41	100%	50	100%	157	100%

The Caucasion race in these four business courses accounted for ninety-five percent of the sample population, while in the Introduction to Business classes, ten percent were other than Caucasion.

The literature search indicated that normally the most efficient independent variables for prediction purposes were the high school grades and scores on achievement/aptitude tests. High school grades were available on the high school transcripts and most students had developed their study habits by the senior year. Also, the senior year would be the most recent prior to entry into college and therefore the grade point average of the senior year of high school was accepted as one of the independent variables.

Florida has a system of testing achievement of its high school seniors in five basic areas and thus it appeared only natural to make use of these test scores as independent variables when developing an instrument to be used for prediction purposes in the Florida community colleges.

Results of the calculations of the computer program STAT 12 for each of the four subjects are presented in TABLES 8 through 11 which reflect the means and standard deviations, and TABLES 12 through 15 which contain the cross correlation matrixes. It was noted that the mean grade in Economics I was 2.29 with a standard deviation of .98 of a grade point, while the mean grade of the sample population in the Introduction to Business classes was 2.56, which was .27 of a grade point higher with a standard

TABLE 8

PRINCIPLES OF MARKETING

SAMPLE STUDENTS - ACADEMIC PERFORMANCE

VARIABLES	MEAN	STANDARD DEVIATION
1. BCC Grade (Marketing)*	2.49	.95
(Florida Twelfth Grade Test Percentile Ranks)		
2. Aptitude (APT)	48.57	22.69
3. English (EH)	43.26	24.67
4. Social Studies (SS)	51.89	24.07
5. Natural Sciences (NS)	52.03	23.83
6. Mathematics (MS)	48.37	26.86
7. Total of all Percentile Ranks (TOT)	245.29	103.82
8. Senior Year High School GPA*	2.91	.61

*Variables Number 1 and 8 are in range 4 = A to 0 = F or W.

TABLE 9

PRINCIPLES OF ECONOMICS

SAMPLE STUDENTS - ACADEMIC PERFORMANCE

VARIABLES	MEAN	STANDARD DEVIATION
1. BCC Grade (Economics)*	2.29	.98
(Florida Twelfth Grade Test Percentile Ranks)		
2. Aptitude (APT)	66.51	21.20
3. English (EH)	57.41	24.27
4. Social Studies (SS)	70.90	18.44
5. Natural Sciences (NS)	69.41	21.19
6. Mathematics (MS)	71.24	21.48
7. Total of all Percentile Ranks (TOT)	334.39	92.56
8. Senior Year High School GPA*	2.96	.59

*Variables Number 1 and 8 are in range 4 = A to 0 = F or W.

TABLE 10

ACCOUNTING I

SAMPLE STUDENTS - ACADEMIC PERFORMANCE

VARIABLES	MEAN	STANDARD DEVIATION
1. BCC Grade (Accounting I)*	2.32	1.01
(Florida Twelfth Grade Test Percentile Ranks)		
2. Aptitude (APT)	63.81	19.63
3. English (EH)	57.35	22.72
4. Social Studies (SS)	64.52	23.61
5. Natural Sciences (NS)	61.06	21.17
6. Mathematics (MS)	67.74	23.44
7. Total of all Percentile Ranks (TOT)	314.94	89.69
8. Senior Year High School GPA*	3.13	.45

*Variables Number 1 and 8 are in range 4 = A to 0 = F or W.

TABLE 11

INTRODUCTION TO BUSINESS

SAMPLE STUDENTS - ACADEMIC PERFORMANCE

VARIABLES	MEAN	STANDARD DEVIATION
1. BCC Grade (Introduction to Business)*	2.56	.88
(Florida Twelfth Grade Test Percentile Ranks)		
2. Aptitude (APT)	60.18	21.96
3. English (EH)	58.74	22.66
4. Social Studies (SS)	62.66	23.62
5. Natural Science (NS)	62.92	20.28
6. Mathematics (MS)	63.54	22.69
7. Total of all percentile Ranks (TOT)	307.36	93.42
8. Senior Year High School GPA*	3.06	.54

*Variables Number 1 and 8 are in range 4 = A to 0 = F or W.

TABLE 12

PRINCIPLES OF MARKETING

CROSS CORRELATION MATRIX
FLORIDA TWELFTH GRADE TEST SCORES (PERCENTILES)
SENIOR YEAR HIGH SCHOOL GRADE POINT AVERAGE AND PRINCIPLES OF MARKETING GRADE

	GRADE	APT	ENG	SOC SCI	NAT SCI	MATH	TOTAL	HS GPA
GRADE	1	.1817024	-.0506142	.1682945	.1862413	.0310878	.1418591	.198962
APT		1	.7258295	.6694535	.6904229	.7202139	.9048634	.2260788
ENG			1	.6490862	.3717686	.6203614	.7930685	.4055179
SOC SCI				1	.6015232	.6871024	.8508737	.3117009
NAT SCI					1	.6970754	.796316	-.026703
MATH						1	.8675186	.1970714
TOTAL							1	.2588391
HS GPA								1

TABLE 13

ECONOMICS I

CROSS CORRELATION MATRIX
FLORIDA TWELFTH GRADE TEST SCORES (PERCENTILES)
SENIOR YEAR HIGH SCHOOL GRADE POINT AVERAGE AND ECONOMICS I GRADE

	GRADE	APT	ENG	SOC SCI	NAT SCI	MATH	TOTAL	HS GPA
GRADE	1	.5070821	.4913914	.5143061	.4979799	.6146039	.5954169	.3110661
APT		1	.7020459	.6777474	.8065337	.7966311	.9289894	.2029219
ENG			1	.6005626	.624359	.6720939	.835898	.3234815
SOC SCI				1	.6542815	.5866087	.7998871	.2876451
NAT SCI					1	.7787814	.8848052	.0025098
MATH						1	.8731765	.2740784
TOTAL							1	.2554136
HS GPA								1

TABLE 14

ACCOUNTING I

CROSS CORRELATION MATRIX
FLORIDA TWELFTH GRADE TEST SCORES (PERCENTILES)
SENIOR YEAR HIGH SCHOOL GRADE POINT AVERAGE AND ACCOUNTING I GRADE

	GRADE	APT	ENG	SOC SCI	NAT SCI	MATH	TOTAL	HS GPA
GRADE	1	-.1912494	.1860996	.1335682	.0456445	.0008151	.0600483	.3483688
APT		1	.6519507	.6934494	.5813891	.7181284	.8790619	.1145454
ENG			1	.4814622	.4322038	.4904279	.7411474	.2258249
SOC SCI				1	.6410179	.606351	.8327705	.0412261
NAT SCI					1	.6937946	.8132177	-.0346656
MATH						1	.8531095	.1185438
TOTAL							1	.1161812
HS GPA								1

TABLE 15

INTRODUCTION TO BUSINESS

CROSS CORRELATION MATRIX
FLORIDA TWELFTH GRADE TEST SCORES (PERCENTILES)
SENIOR YEAR HIGH SCHOOL GRADE POINT AVERAGE AND INTRODUCTION TO BUSINESS GRADE

	GRADE	APT	ENG	SOC SCI	NAT SCI	MATH	TOTAL	HS GPA
GRADE	1	.1817328	.2569217	.1891035	.1094967	.2236112	.2136535	.2211616
APT		1	.7167718	.7042733	.6314754	.7307439	.909676	.2816857
ENG			1	.5683393	.4570136	.6576189	.8098447	.2453582
SOC SCI				1	.7019188	.5533601	.8352228	.1232822
NAT SCI					1	.6305416	.8009069	.1136683
MATH						1	.839576	.2740306
TOTAL							1	.2543416
HS GPA								1

deviation of only .88 of a grade point. The senior high school year grade point average of the sample groups varied from a low of 2.91 in Principles of Marketing to a high of 3.13 in Accounting I. While the senior year high school grades (GPA) of the sample population, as evidenced by the means, were the highest of the four subjects in Accounting I, it was interesting to note that this group had the smallest standard deviation in the high school grades.

The differences between the four sample populations in the Florida twelfth grade test scores were much more pronounced than in the high school grades and the grades earned in the courses. All of the mean score percentiles of the five tests in the Marketing sample were lower than any of the scores of the three other sample groups. The highest percentile mean score in Marketing was obtained in the natural science test with a percentile of 52.03 while the lowest in any of the other groups was a percentile score of 57.35 by the Accounting I group in the English (EH) test. The total of the five scores in the Marketing sample was 245.29 which was 62.07 points lower than the second lowest group - Introduction to Business. This reveals that the Marketing sample student averaged about 12 percentile points lower than the Introduction to Business group and about 18 percentile points lower than the Economics group, which had the highest total score - 334.39.

Results of the analyses of the cross correlation matrixes generated by the computer program STAT 12 and reported as TABLES 12 through 15 are discussed below.

1. Principles of Marketing. Analysis of the Cross Correlation Matrix for the Principles of Marketing student sample as shown in TABLE 12 revealed the highest correlation was between the dependent variable and the high school senior grade point average .1990. Two test scores, aptitude and natural science, had correlations with grade earned of .1817 and .1862. However, the aptitude test score revealed a much higher correlation with the other test scores, and it was determined appropriate to use the grade point average and the aptitude test score percentile for the multiple regression analysis. It was also noted that the high school senior year GPA had a relatively low correlation with the various test scores, adding to the desirability of using it as one of the independent variables.
2. Economics I. Analysis of TABLE 13 revealed that the highest test score correlation to grade earned was the mathematics test with a cross correlaion of .6146. This test also had a high correlation with the other test scores. The senior year high school GPA had a correlation of .3111 with the grade earned, and a relatively low correlation with the various test scores. The high school GPA and mathematics test scores became the two independent variables for prediction of grades in Economics I.
3. Accounting I. Analysis for Accounting I as shown in TABLE 14 revealed that the senior year high school GPA had the highest

correlation to the grade earned but a very low correlation to test score percentiles. The English twelfth grade test score percentile was selected for use as the second independent variable in the multiple regression analysis. It was interesting and considered unusual that the correlation of the aptitude test score to grade earned was a negative correlation, indicating an inverse linear relationship.

4. Introduction to Business. Analysis revealed that the English twelfth grade test score had the highest correlation to grade earned .2569, as shown in TABLE 15, while the correlation between high school senior year GPA and grade was .2212. These two independent variables was selected for use in the multiple regression analysis for the Introduction to Business courses.

The results of computing the coefficient of correlation and the error of the estimate for each subject by the use of the computer program MULFIT, are presented in TABLE 16. Analysis of the computations pertaining to Economics I reveals coefficient of determination of .3997. This means that about forty percent of the variations in the grade earned in Economics I by the sample population were due to variations in the senior year grade point average and variations in the Florida twelfth grade mathematics percentile score. The square root of the coefficient of determination was .6322 which represents (R) or the coefficient of correlation.

Grade prediction tables developed for each of the subjects, using the multiple regression equations obtained from the computer calculations are presented in TABLES 17-20.

TABLE 16

RESULTS OF MULTIPLE REGRESSION ANALYSES AND STATISTICAL COMPUTATIONS

PRINCIPLES OF MARKETING

Coefficient of Determination: .0592864
Coefficient of Correlation: .2434879
Prediction Equation: $Y = 1.442163 + .0660387\ A + .25756\ G$
Error of the Estimate: ± .95 of one grade point

ECONOMICS I

Coefficient of Determination: .3997301
Coefficient of Correlation: .6322421
Prediction Equation: $Y = .3280156 + .021326\ M + .25681\ G$
Error of the Estimate: ± .78 of one grade point

ACCOUNTING I

Coefficient of Determination: .0440367
Coefficient of Correlation: .2098492
Prediction Equation: $Y = 2.212929 + .0105739\ E - .16363\ G$
Error of the Estimate: ± 1.06 grade points

INTRODUCTION TO BUSINESS

Coefficient of Determination: .0870622
Coefficient of Correlation: .295063
Prediction Equation: $Y = 1.239229 + .007878\ E + .28062\ G$
Error of the Estimate: ± .86 of one grade point

Y = Predicted grade
A = Aptitude twelfth grade test score (percentile)
G = Senior year high school grade point average
M = Mathematics twelfth grade test score (percentile)
E = English twelfth grade test score (percentile)

TABLE 17

PRINCIPLES OF MARKETING

GRADE PREDICTIONS USING THE FLORIDA TWELFTH GRADE APTITUDE TEST SCORE AND THE SENIOR YEAR HIGH SCHOOL GRADE POINT AVERAGE

GRADE POINT AVERAGE

		1.0	1.5	2.0	2.5	3.0	3.5	4.0
	10	1.76	1.88	2.02	2.15	2.28	2.40	2.53
	20	1.82	1.95	2.08	2.21	2.34	2.46	2.59
	30	1.88	2.01	2.14	2.27	2.40	2.52	2.65
	40	1.94	2.07	2.20	2.33	2.46	2.59	2.71
APTITUDE SCORE (PERCENTILE)	50	2.00	2.13	2.26	2.40	2.51	2.65	2.77
	60	2.06	2.19	2.32	2.45	2.58	2.71	2.83
	70	2.12	2.25	2.38	2.51	2.64	2.77	2.90
	80	2.18	2.31	2.44	2.57	2.70	2.83	2.96
	90	2.24	2.37	2.50	2.63	2.76	2.89	3.02
	99	2.30	2.43	2.56	2.68	2.81	2.94	3.07

When this table is used as a predictor of Marketing I grades, 68% of the students will achieve grades within ± .95 of the values in the table.

The table was prepared using the equation:

$Y = 1.442163 + .0060387A + .25756G$
Y = Predicted Marketing grade
A = Twelfth grade aptitude test score (percentile)
G = Senior high school year grade point average

TABLE 18

PRINCIPLES OF ECONOMICS

GRADE PREDICTIONS USING THE FLORIDA TWELFTH GRADE MATH TEST SCORE AND THE SENIOR YEAR HIGH SCHOOL GRADE POINT AVERAGE

GRADE POINT AVERAGE

		1.0	1.5	2.0	2.5	3.0	3.5	4.0
	10	.19	.32	.45	.58	.70	.83	.96
	20	.45	.58	.71	.84	.97	1.09	1.22
	30	.71	.84	.97	1.10	1.23	1.35	1.48
	40	.97	1.10	1.23	1.40	1.49	1.62	1.74
MATH SCORE (PERCENTILE)	50	1.24	1.36	1.49	1.62	1.75	1.88	2.01
	60	1.50	1.63	1.75	1.88	2.01	2.14	2.27
	70	1.76	1.89	2.01	2.14	2.27	2.40	2.53
	80	2.02	2.15	2.28	2.40	2.53	2.66	2.79
	90	2.28	2.41	2.54	2.67	2.79	2.92	3.05
	99	2.52	2.64	2.77	2.90	3.03	3.16	3.29

When this table is used as a predictor of Economics I grades, 68% of the students will achieve grades within ± .78 of the values in the table.

The table was prepared using the equation:

$Y = .3280156 + .0261326M + .25681G$
Y = Predicted Economics Grade
M = Twelfth Grade Math test score (percentile)
G - Senior high school year grade point average

TABLE 19

ACCOUNTING I

GRADE PREDICTIONS USING THE FLORIDA TWELFTH GRADE ENGLISH TEST SCORE AND THE SENIOR YEAR HIGH SCHOOL GRADE POINT AVERAGE

GRADE POINT AVERAGE

		1.0	1.5	2.0	2.5	3.0	3.5	4.0
	10	2.16	2.07	1.99	1.91	1.83	1.75	1.66
	20	2.26	2.17	2.10	2.02	1.93	1.85	1.77
	30	2.37	2.28	2.20	2.12	2.04	1.96	1.88
	40	2.47	2.39	2.31	2.23	2.15	2.06	1.98
ENGLISH SCORE (PERCENTILE)	50	2.58	2.50	2.41	2.33	2.25	2.17	2.09
	60	2.68	2.60	2.52	2.44	2.36	2.28	2.19
	70	2.79	2.71	2.63	2.55	2.46	2.38	2.30
	80	2.90	2.81	2.73	2.65	2.57	2.49	2.40
	90	3.00	2.92	2.84	2.76	2.67	2.59	2.51
	99	3.10	3.01	2.93	2.85	2.77	2.69	2.61

When this table is used as a predictor of Accounting I grades, 68% of the students will achieve grades within ± 1.06 of the values in the table.

The table was prepared using the equation:

$Y = 2.212929 + .0105739E - .16363G$
Y - Predicted Accounting I Grade
E = Twelfth Grade English test score (percentile)
G = Senior year high school grade point average

TABLE 20

INTRODUCTION TO BUSINESS

GRADE PREDICTIONS USING THE FLORIDA TWELFTH GRADE ENGLISH TEST SCORE AND THE SENIOR YEAR HIGH SCHOOL GRADE POINT AVERAGE

GRADE POINT AVERAGE

		1.0	1.5	2.0	2.5	3.0	3.5	4.0
	10	1.60	1.74	1.88	2.02	2.16	2.30	2.44
	20	1.68	1.82	1.96	2.10	2.24	2.38	2.52
	30	1.76	1.90	2.04	2.18	3.32	2.46	2.60
	40	1.83	1.97	2.12	2.26	2.40	2.54	2.68
ENGLISH SCORE (PERCENTILE)	50	1.91	2.05	2.19	2.33	2.47	2.62	2.76
	60	1.99	2.13	2.27	2.41	2.55	2.69	2.83
	70	2.07	2.21	2.35	2.49	2.63	2.77	2.91
	80	2.15	2.29	2.43	2.57	2.71	2.85	2.98
	90	2.23	2.37	2.51	2.65	2.79	2.93	3.07
	99	2.30	2.44	2.58	2.72	2.86	3.00	3.14

When this table is used as a predictor of Introduction to Business Grades, 68% of the students will achieve grades within ± .86 of the values in the table.

The table was prepared using the equation:

$Y = 1.239229 + .007878E + .28062G$
Y = Predicted Introduction to Business Grade
E = Twelfth Grade English test score (Percentile)
G = Senior year high school grade point average

Analysis of these prediction tables, for example, will reveal that a recent Brevard County high school graduate with a senior year grade point average of 2.5 and a percentile score of 50 on his Florida twelfth grade aptitude test could expect to receive a grade of 2.40 - a "C" in the Principles of Marketing course at BCC. Based upon these predictions, the computed standard error of the estimate indicates that approximately sixty-eight percent of the students with these scores will earn a Principles of Marketing grade within plus or minus .95 of a grade point of the predicted score. Similar predictions or estimates of success can be made from the other three prediction tables.

The results of this study, in an abbreviated form, were compiled as a model package which could be used by other community colleges in Florida to develop and prepare similar prediction tables for their own institutions. This model is presented as Appendix I. Essentially, the model demonstrates how to replicate the study in any Florida community college.

CHAPTER V

SUMMARY, FINDINGS, IMPLICATIONS AND STRATEGY FOR IMPLEMENTATION, AND RECOMMENDATIONS

SUMMARY

This research examined the possibilities of developing and evaluating a relatively simple instrument which could be presented as a manual to be used by professional counselors, para-professional program advisors, and business administration instructors when advising potential business students. The instrument developed was intended to be used to predict the success of high school students and graduates who planned to enter Brevard Community College the term following their graduation. The study was conducted at Brevard Community College, Cocoa, Florida, using as the sample population all 1973 and 1974 graduates from the eleven high schools located in Brevard County, who enrolled in certain business courses during the semester following high school graduation.

The study was essentially a discriminate prediction study as the objective was to use certain independent variables as the bases for predicting success in specific business courses. The independent variables were the high school grades (grade point average earned during the senior year in high school) and the scores earned on the Florida twelfth grade testing program tests, which yields percentile scores for five separate sections and a total. These variables were used to determine how well prospective students would perform in four different business courses: (1) Principles of Marketing, (2) Principles of Economics I, (3) Accounting I, and (4) Introduction to Business. These are core courses in various business majors at BCC.

It was contemplated that separate prediction tables would be developed for each of the four subject areas. In accomplishing this task it was possible to eliminate all of the independent variables except two. By detailed analysis of the cross correlation matrixes calculated by the use of a computer terminal connected to a time-sharing computer, the number of independent variables was reduced to two. These were the grade point average for the senior year in high school and the Florida test score, either one of the five section scores or the total having the highest predictive potential.

The grade earned in each course, the dependent variable, and the two independent variables were then used to calculate a multiple regression analysis for each of the subjects and to compute the regression or prediction equation. These equations were then used as the bases for development of the prediction tables (TABLES 17 through 20).

The statistical computations and the prediction tables served as the bases for development of a model which could be used by community colleges throughout the state. This model provided a description of the steps and procedures required to collect and assemble the data, perform the computations, prepare the prediction tables, and finally to calculate the validity and reliability of the predictions.

FINDINGS

A model for a simple-to-use prediction instrument to be presented as a manual for use by professional counselors, para-professional program advisors and business administration instructors has been created and evaluated. The evaluation consisted of computations of the coefficient of determination, coefficients of correlation and the errors of the estimates. The evaluation indicated that a large percentage of variations in attempting the prediction of success remained unexplained, but enough is explained to encourage counselors and instructors at BCC to use the specific prediction formula presented in efforts to counsel students better toward or away from specific business courses.

An immediate reservation is urged because of the low coefficient of determination, but only those students with very low predicted success should be discouraged, specifically as regards the four predictor formulas.

Analyses of the four prediction equations developed revealed a standard error of the estimate which ranged from a low of plus or minus .78 of a grade point in Economics I to a high of 1.06 grade points in Accounting I. Further analysis revealed that approximately forty percent of the variations in grade earned in Economics I could be attributed to variations in the independent variables (grade point average and the Florida mathematics score) which resulted in a coefficient of correlation (r) of .63. Computations of the coefficient of determination relating to Accounting I revealed that only four percent of the variations in grade earned were attributable to variations in the independent variables. In this instance the coefficient of correlation (r) was .21.

The variations in the standard error of the estimate for the four subject courses were not regarded as too great. However, the variations in the coefficients of determination and coefficients of correlation, when interpreted, show approximately forty percent of the variations in Economics I were attributable to variations in the independent variables, while in the three other subjects less than ten percent of the variations in grade could be attributed to the variations in the independent variables. This leaves a large amount of unexplained variations.

IMPLICATIONS AND STRATEGY FOR IMPLEMENTATION

The discriminate prediction tables prepared for BCC were based on a sample population drawn from the eleven high schools located in Brevard County. These tables will be made available to BCC counselors, business administration instructors, and the para-professional program advisor assigned to the business division. They will be useful in helping students to determine their initial business course selections and to obtain information as to how well other students with similar academic backgrounds have succeeded in these courses.

Similar prediction tables, developed for use by individual high school counselors throughout the county, might be even more valid and reliable than those developed in this study. A sample drawn from an individual high school would be particularly desirable for use with the model to generate prediction tables applicable to the graduates of that high school. The prediction tables thereby developed would serve as valuable tools for counseling.

Copies of the model developed in this study will be distributed to selected Florida community colleges in anticipation of their developing similar prediction tables for use within their institutions. Contact will be maintained with those institutions to obtain evaluations of the model from different sources with different sample populations.

The model developed in this study related to only one segment of the prospective BCC student body - the recent high school graduate. In view of the large number of older mature adults who currently enroll in the community colleges, an effort to develop a model designed to aid in counseling this category of personnel appears appropriate.

RECOMMENDATIONS

During the conduct of this study, several areas in which additional research is indicated were brought to light. Recommendations for further research studies follow:

1. Determine how to reduce the amount of unexplained variations in the prediction process. This study could well include a detailed analysis of grading procedures followed by individual instructors to determine the effect of these on the various predictor variables.
2. Expand the research to include predicting success for other segments of the potential student population. This study should include other categories of students, such as the older mature students and veterans, which are sufficiently large to justify the expenditure of time, money and equipment.
3. Analyze the overall grading procedures existing in the system. There is considerable doubt as to the standard of grading by

individual instructors. It appears to be common knowledge among students that one of the best ways to insure a good grade is to enroll in specific instructors' classes. While academic freedom is an essential element in education, some standardization of the grading system seems appropriate. A student's grade should be determined by his progress, as measured by his knowledge and abilities in a given subject at the end of the course, rather than the instructor in whose class he is enrolled.

4. Study the policies and procedures relating to award of the "W" grade. Thirty-eight percent of the 157 students included in the original sample used in this research were awarded a grade of "W" and no "F" grades were recorded. An analysis of sixty-one of the BCC August to December, 1974, classes in business revealed that twenty-nine percent of the 2003 students received a "W" grade.
5. Assess the methods of measuring attitudes and motivation of individual students. It was noted that many students with relatively low high school grades and percentile scores on the Florida tests received good grades. An ability to measure attitudes and motivation of prospective students should result in increased efficiency in the counseling process.

BIBLIOGRAPHY

Aiken, J. 1968. A Comparison of Junior College Withdrawal. ERIC Clearinghouse of Junior Colleges.

Astin, A., 1972. College Dropouts: National Profile. American Council on Education Research Reports, Vol. 7, No. 1. Washington:ACE.

Barton, George M. and Rankin, Gary E. 1967. Florida Junior College Project: Report on Phase I. JCR-67-1. Prepared for the Florida Task Force on Testing by Educational Testing Service. Princeton, New Jersey.

Beninate, N. and Boutelle, M. 1973. A Study Relating to Student Withdrawal Rate and Class Size In Basic Accounting And Business Statistics In Brevard Community College. Practicum submitted to Nova University.

Biggs, Donald A. and Johnson, James 1972. Self-Made Academic Predictions of Junior College Students. The Journal of Educational Research, Vol. 66, Number 2, October, 1972.

Borup, J. H. 1971. The Validity of the American College Test for Discerning Potential Academic Achievement Levels: Ethnic and Sex Groups. Journal of Educational Research. September.

Boutelle, M. 1975. A Study To Determine If A Basic Accounting Class Can Be Successfully Taught With Programmed Materials In A Regular Classroom Setting. Practicum submitted to Nova University.

Bowles, F. and DeCosta, F. A. 1971. Between Two Worlds. New York: McGraw-Hill.

Brevard Community College Catalog 1974-75. 1974. Brevard Community College, Cocoa, Florida.

Brim, O. G., Jr. 1965. High and Low Self-Estimates of Intelligence, Intelligence Perspectives. Harcourt, Brace and World, New York. pp. 65-101.

BIBLIOGRAPHY (Continued)

Cohen, A., and Brawer, R. 1970. Student Characteristics: Personality and Dropout Propensity. Washington: American Association of Junior Colleges.

Cole, N. S. 1969. Differential Validity in the ACT Tests, ACT Research Report, No. 30 Iowa City: American College Testing Program.

Commission on Tests. 1970. Report of Commission on Tests:I. Righting The Balance. New York: College Entrance Examination Board.

Cope, R. J. 1968. Limitations of Attrition Rates and Causes Given For Dropping Out of College. Journal of College Student Personnel. 9.386-392.

Galvin, Kenven 1973. A Study of Instructional Variables and Student Completion. Research Office, Southwestern College, Chula Vista, Calif.

Gell, Robert L., and Bleil, David F. 1971. Grades--Scores--Predictions: A Study of the Efficiency of High School Grades and American College Test Scores in Predicting Academic Achievement at Montgomery College. Montgomery College, Rockville, Md.

Gourley, Martha H. 1971. Validity Study Report - First Term 1970-1971 Academic Year. Danville Community College, Danville, Virginia.

Greenberg, Barry. 1972. Predicting Who Will Withdraw During Their First Semester of Attendance at Miami-Dade Junior College. Miami-Dade Junior College, Florida Department of Educational Research.

Heinkel, Otto A., and Peerson, R. H. 1971. Analysis of Prospective and Present Students in the San Diego Junior Colleges Relative to Their Vocational Programs. San Diego Community College.

Hendrix, Vernon. 1968. The Prediction of Grade Point Average and Selected Course Grades From ACT Program Scores and Status as a High School Graduate. ERIC, Ed 029 638, December, 1968, p. 3.

BIBLIOGRAPHY (Continued)

Hill, A. H. 1966. A Longitudinal Study of Attrition Among High Aptitude College Students. Journal of Educational Research, 60:166:173, December.

Jaffe, A. J., Adams, W.,and Meyers, S. 1968. Negro Higher Education in the 1960's. New York:Praeger.

Landini, Albert J. 1972. Index of Effort: An Analytical Model For Evaluating and Re-Directing Student Recruitment Activities for a Local Community College. ERIC ED 060 843. JC 720 087.

Lavon, D. C. 1965. The Prediction of Academic Performance. Russel Sage Foundation, New York.

Lynch, Mary V. 1970. Predictive Models for Success in Occupational Education. Occupational Research Final Report. Wayne Community College, Greensboro, N.C.

MacMillan, Thomas F. 1969. Establishing a Predictive Model for Early Recognition of Potential Community College Student Attrition. Los Angeles: ERIC for Junior Colleges, ACC No. Ed 044102.

McFaddin, R. W. 1971. A Predictive Model For Academic Success at the University of Florida. University of Florida Doctoral Dissertation.

Malone, F. E. Jr. 1965. A Study of Students Enrolled in Post High School Public Vocational Education Programs in Iowa During the 1964-65 School Year. Unpublished Doctoral Dissertation, The State University of Iowa, Ames, Iowa.

Miller, G. W. 1970. Success, Failure, and Wastage in Higher Education. London: George G. Harrap.

Morgan, M. K. 1971. The OPI, the ACT and University Attrition: A Di-Criminant Analysis. Dissertation Abstracts International, 31:3906-3907, 8-A, Feb., 1971.

BIBLIOGRAPHY (Continued)

Pedrini, Bonnie C. and Pedrini, D. T. 1973. Predictions of College Achievement and Attrition. ERIC ED 083 535 CS 000-768.

_______. 1974. Predictors of College Success. University of Nebraska at Omaha, Omaha, Nebraska.

Poindexter, Charles C. 1970. Degrees and Dropouts: A Profile of Student Characteristics in North Carolina Community Colleges. Thesis in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy in the School of Education, Chapel Hill, North Carolina: University of North Carolina.

Press, N. B. 1970. A Study of the Relationship Between Selected Variables and Academic Achievement in a Community College. North Carolina University, Department of Adult Education, Ed. D. Thesis. Washington, D C.: ERIC Clearinghouse on Adult Education, October, 1970.

Prediger, D. J., Waple, C. C., and Nusbaum, G. R. 1968. Predictors of Success in High School Level Vocational Education Programs: A Review, 1954-1967. Personnel and Guidance Journal, XLVII October, 1968. 137-145.

Reed, M. D. 1968. Prediction Studies Based on ACT Research Project No. 1 - 68. Central Virginia Community College, Lynchville, Virginia.

Reese, Harold D. 1971. Statement Regarding Predictions. Assistant Director of Certification and Accreditation for Maryland State Department of Education.

Robinson, L. R. 1969. Relation of Student Persistence in College To Satisfaction with Environmental Factors. Journal of Educational Research. September, 1969.

Smith, J. L. 1975. A Follow-Up Evaluation of Brevard Community College Graduates at Senior Colleges and in Employment as of May, 1973 - August, 1974. Brevard Community College, Cocoa, Florida.

BIBLIOGRAPHY (Continued)

Spiegel, D. and Spiegel, P. K. 1971. Multiple Predictors of Course Grades for College Men and Women. Journal of College Student Personnel 12 (1):44-48, January

Starr, A., Betz, E., and Menne, J. 1972. Differences in College Student Satisfaction: Academic Dropouts: Non-Academic Dropouts and Non-Drop-Outs. Journal of Counseling Psychology. 19:318-322, July, 1972.

Stock, William E., Pratzner, Frank C. 1969. Review of Research on Student Selection and the Prediction of Success in Occupational Education. Minnesota Research Coordinating Unit in Occupational Education, Minneapolis, August, 1969.

Stockton, J. R. and Clark, C. T. 1971. Introduction to Business and Economic Statistics. South-Western Publishing Company, Cincinnati, Ohio.

Toronto Board of Education (Ontario). Research Department. 1973. Aptitude Testing: A Critical Examination of the Differential Aptitude Tests, Alternative Batteries, and Problems in Prediction.

University of Florida. 1973. Percentile Ranks Florida Statewide Twelfth Grade Testing Program. University of Florida Press, Gainesville.

Wattenbarger, James L. 1973. Brevard Community College Ten Year Development Plan. Associated Consultants in Education, Tallahassee, Florida P. 37.

Wood, S. E. 1968. Relationship of Certain Non-intellective Factors to Persistence. Washington, D. C. ERIC Clearinghouse on Junior Colleges.

APPENDIX

A MODEL FOR PREDICTING SUCCESS IN FLORIDA COMMUNITY COLLEGES FOR RECENT HIGH SCHOOL GRADUATES

Maurice H. Boutelle

Nova University

1975

TABLE OF CONTENTS

Page

LIST OF TABLES iii

CHAPTER:

I. INTRODUCTION 1
   DEFINITIONS 2
   CRITERIA 2
   PREDICTORS 2

II. PROCEDURES 3

III. RESULTS 10

IV. SUMMARY 18

LIST OF TABLES

Table Page

1. BREVARD COUNTY HIGH SCHOOL GRADUATES ENROLLED IN BREVARD COMMUNITY COLLEGE WHO INDICATED BUSINESS AS THEIR MAJOR PROGRAM.. 4

2. BREVARD COUNTY HIGH SCHOOL GRADUATES ENROLLED IN BUSINESS COURSES AT BREVARD COMMUNITY COLLEGE....................... 5

3. SAMPLE STUDENT DATA - ACCOUNTING SAMPLE.................. 7

4. A COMPARISON OF GRADES EARNED BY SAMPLE STUDENTS IN SELECTED BUSINESS COURSES............................... 11

5. A COMPARISON OF GRADES EARNED BY SAMPLE STUDENTS IN SELECTED BUSINESS COURSES - REVISED.................... 12

6. PRINCIPLES OF MARKETING - SAMPLE STUDENT - ACADEMIC PERFORMANCE.. 13

7. PRINCIPLES OF MARKETING - CROSS CORRELATION MATRIX........ 14

8. RESULTS OF MULTIPLE REGRESSION ANALYSES AND STATISTICAL COMPUTATIONS.................................. 16

9. PRINCIPLES OF MARKETING - GRADE PREDICTIONS USING THE FLORIDA TWELFTH GRADE APTITUDE TEST SCORE AND THE SENIOR YEAR HIGH SCHOOL GRADE POINT AVERAGE............... 17

A MODEL FOR PREDICTING SUCCESS IN FLORIDA COMMUNITY COLLEGES FOR RECENT HIGH SCHOOL GRADUATES

CHAPTER I

INTRODUCTION

This booklet is presented as a model for predicting success in business courses in a Florida community college for those Florida high school graduates who enter college the semester following graduation and enroll in business courses during their first semester. The model is based upon the assumption that the students used as the sample population and those for whom success will be predicted have completed the Florida twelfth grade testing program and that the high school senior year grade point average is available.

Institutions of higher education generally seek some method of predicting, prior to enrollment, the success of students in their particular institution. The open door policy in the community colleges of Florida, the high attrition rate, and the wide variety of offerings of the community colleges make this type of predictive study almost a necessity.

The community college philosophy of something for everyone carries a professional responsibility to exert every effort and to use the best available means to guide incoming students towards appropriate courses and a curriculum commensurate with their ability.

This model was developed in a study conducted at Brevard Community College (BCC), a multi-campus community college in Cocoa, Florida, with additional campus locations in Melbourne and Titusville. Approximately thirty-five percent of the graduates from the eleven high schools located in Brevard County attend Brevard Community College. Thus, it was considered especially appropriate to develop a predictive instrument to be used by professional counselors, para-professional program advisors, and business administration instructors, to help those students select their initial courses of instruction. This model was developed as a discriminate prediction study for those high school graduates who had indicated a desire to choose a business program as their major field of study.

DEFINITIONS

CRITERIA

Grade earned in a specified business course based on a four point system. A - 4.00, B - 3.00, C - 2.00, D - 1.00, and W or F - 0.00.

PREDICTORS

Grade point average for the senior year of high school, based on a four point system as above.

Test scores (percentiles) obtained in the Florida twelfth grade testing program, as indicated below:

1. Aptitude achievement score (APT)
2. English achievement score (EH)
3. Social studies achievement score (SS)
4. Natural science achievement score (NS)
5. Mathematics achievement score (MS)
6. Total of the above five scores (TOT)

CHAPTER II

PROCEDURES

The sample population of students in this research included all 1973 and 1974 high school graduates from the eleven high schools located in Brevard County who enrolled in Brevard Community College the semester following graduation and who indicated business as their major program of study. The listings of these students were obtained from the college Data Services Center, as shown in TABLE 1.

These rosters of students were compared with the BCC master schedule of classes, located in the registrar's office, to determine which business subjects the sample students were enrolled and the grades they had earned in these courses. Tally sheets were then prepared to determine the number of students enrolled in each of these business classes. Based upon these results, the courses for which discriminate predictions could be developed were determined and the number contained in each of the individual samples is shown in TABLE 2.

Separate rosters of students selected for the discriminate prediction studies in each subject were prepared as indicated in TABLE 3. When more names than required were available, a random selection technique was used to obtain the desired sample population size. The use of a random numbers table was considered an acceptable method of selection.

Student records, for the sample population, were examined to obtain grade point average for the senior year of high school and results of the

TABLE 1

1974 BREVARD COUNTY HIGH SCHOOL GRADUATES ENROLLED IN BREVARD COMMUNITY COLLEGE IN AUGUST, 1974 WHO INDICATED "BUSINESS" AS THEIR MAJOR PROGRAM

NAME	STUDENT NUMBER	YEAR OF BIRTH	SEX*	RACE*	HIGH* SCHOOL	MAJOR* PROGRAM
Adams, Henry	74-13346-1	55	1	3	01	103
Jones, John	74-12345-1	56	1	5	16	102

* Numerical Codes are used to represent these items.

Note: Student names are fictitious.

TABLE 2

BREVARD COUNTY HIGH SCHOOL GRADUATES (1973 & 1974) ENROLLED IN BUSINESS COURSES AT BREVARD COMMUNITY COLLEGE

COLLEGE COURSE	1973 HIGH SCHOOL GRADUATES	1974 HIGH SCHOOL GRADUATES	TOTAL
Accounting I	11	20	31
Principles of Economics	11	30	41
Principles of Marketing	11	24	35
Introduction to Business	58	72	130
TOTALS	91	146	237

Florida twelfth grade test scores in percentiles. In most instances the grade point average had to be computed as this action had not been accomplished and recorded on the high school transcripts. In event a student's record contained no indication of completion of the Florida twelfth grade tests, the score was obtained from the annual University of Florida publication of test scores. If the student had not taken the tests, a substitute name was obtained. Substitute names were selected from the original list whenever the list contained more names than required. However, if no additional names were available, a substitute was selected from an earlier year of graduation. Completion of the rosters (TABLE 3) by entering the senior year grade point average and the Florida test score percentiles was facilitated by the use of Xerox copies of the high school transcripts.

In view of the current practice of authorizing the award of a "W" (withdrawal) rather than an "F" (failure), individual instructors were contacted to determine which, if any, of the "W" grades would have been "F" under a policy which permitted use of the "W" grade only for those students who had not completed a course. Names of those students who did not complete the course were deleted from the list and substitute names were obtained.

The completed rosters served as source data information for the preparation of paper tapes, used in the computer terminal, to calculate the mean, standard deviation of each variable, and a cross correlation matrix of all variables for each subject. Brevard Community College has a computer

TABLE 3

SAMPLE STUDENT DATA
ACCOUNTING SAMPLE

NAME	GRADE	SEX*	RACE*	FLORIDA TWELFTH GRADE TEST PERCENTILE RANKS APT	EH	SS	NS	MS	TOT	GPA
Adams, Henry	C	1	5	54	38	64	80	56	292	3.00
Bierbaum, Theresa	A	2	3	27	34	59	37	66	223	3.70
Johnson, Theodore	D	1	5	63	62	90	83	25	323	2.58

* Numerical codes are used to represent these items.

Note: Student names are fictitious.

terminal connected to a Honeywell Series 600 - 6000 time sharing computer. The program STAT 12, a BASIC language program, was selected for these computations and was run, using the prepared paper tapes as input to the computer terminal.

Each cross correlation matrix obtained in the computer printout was analyzed to determine the two variables with the highest correlation to grade earned. The procedure used to identify the best combination of predictor variables was to select the predictors that correlated high with the criterion (grade earned) but correlated low with each other. The two selected independent variables and the grades earned in each subject were used for conducting a multiple regression analysis which produced a regression equation. A review of the literature indicated that the high school grades and aptitude/achievement tests are the two best indicators for use in predicting success, thus the grade point average for the senior year in high school and one of the Florida twelfth grade percentiles scores, or the total, were used as the independent variables.

The rosters again served as the source data for the preparation of paper tapes containing the dependent and the selected independent variables which were used in computing individual subject prediction equations with multiple regression analysis. The computer program MULFIT, a BASIC language program, was selected to compute the multiple regression coefficients, the constant (y intercept) and the coefficient of determination. The program was run, using the paper tapes as input to the computer terminal.

The computer output was analyzed and calculations were performed to determine the coefficient of correlation and the standard error of the estimate. The regression equations were then used to prepare prediction tables.

$$\widehat{\sigma_{1.23}} = \sqrt{\frac{\sum x_1^2 - a\sum x_1 - b\sum x_1 x_2 - c\sum x_1 x_3}{n-m}}$$

$\widehat{\sigma_{1.23}}$ - Standard error of the estimate

x_1 - Grade earned (4 point scale A = 4, B - 3, etc.)

x_2 - Percentile score - Florida Twelfth Grade Test

x_3 - Senior year high school grade point average

a - Constant - y intercept

b - Regression coefficient 12.3

c - Regression coefficient 13.2

n - Number of observations

m - Number of constants in regression equation

CHAPTER III

RESULTS

The listings of the 1973 and 1974 Brevard County high school graduates who entered BCC the term following graduation, and who indicated a desire to major in business, contained 314 names. Of the 237 enrolled in business courses during their first semester of attendance, 157 were included in the sample population selected for this research. Seventy names were deleted from the Introduction to Business listing by the use of a random numbers table used as the selection technique.

Grades earned by the sample population as shown in TABLE 4 revealed that thirty-eight percent of the students were awarded a grade of "W," indicating withdrawal from the course. Individual instructors were contacted to determine which, if any, of these students actually finished the course and were awarded a grade of "W" rather than an "F." Those students who did not complete the course were deleted from the listings and substitute names were obtained. Grades of the revised sample are shown in TABLE 5.

Results of the computer calculations from program STAT 12 are presented in TABLES 6 and 7. Analysis of the printout of these results revealed the mean grade earned in Marketing was 2.49 with the standard deviation being .95 of a grade point. The program further revealed this sample population had a mean grade point average for the senior year in high school of 2.91, with the standard deviation being .61 of a grade point.

The cross correlation matrix for marketing revealed the highest correlation to grade earned was .1990 (high school grade point average),

TABLE 4

A COMPARISON OF GRADES EARNED BY SAMPLE STUDENTS IN SELECTED BUSINESS COURSES

Grade	Subject									
	Accounting I		Principles of Marketing		Principles of Economics		Introduction To Business		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
A	5	16	1	3	2	5	9	18	17	11
B	8	26	9	26	6	15	14	28	37	24
C	4	13	10	28	13	32	10	20	37	24
D	0	0	3	9	1	2	3	6	7	4
W or F	14	45	12	34	19	46	14	28	59	38
Totals	31	100%	35	100%	41	100%	50	100%	157	100%

TABLE 5

A COMPARISON OF GRADES EARNED BY SAMPLE STUDENTS IN SELECTED BUSINESS COURSES

(REVISED)

Grade	Subject									
	Accounting I		Principles of Marketing		Principles of Economics		Introduction To Business		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
A	4	13	5	14	5	12	7	14	21	13
B	9	29	12	34	10	24	20	40	51	32
C	11	36	14	40	20	49	17	34	62	40
D	6	19	3	9	4	10	6	12	19	12
F	1	3	1	3	2	5	0	0	4	3
Totals	31	100%	35	100%	41	100%	50	100%	157	100%

TABLE 6

PRINCIPLES OF MARKETING

SAMPLE STUDENTS ACADEMIC PERFORMANCE

VARIABLES	MEAN	STANDARD DEVIATION
1. BCC Grade (Marketing)*	2.49	.95
(Florida Twelfth Grade Test Percentile Ranks)		
2. Aptitude (APT)	48.57	22.69
3. English (EH)	43.26	24.67
4. Social Studies (SS)	51.89	24.07
5. Natural Sciences (NS)	52.03	23.83
6. Mathematics (MS)	48.37	26.86
7. Total of all Percentile Ranks (TOT)	245.29	103.82
8. Senior Year High School GPA*	2.91	.61

*Variables Number 1 and 8 are in range 4 = A to 0 - F or W.

TABLE 7

PRINCIPLES OF MARKETING

CROSS CORRELATION MATRIX
FLORIDA TWELFTH GRADE TEST SCORES (PERCENTILES)
SENIOR YEAR HIGH SCHOOL GRADE POINT AVERAGE AND PRINCIPLES OF MARKETING GRADE

	GRADE	APT	ENG	SOC SCI	NAT SCI	MATH	TOTAL	HS GPA
GRADE	1	.1817024	-.0505142	.1682945	.1862413	.0310878	.1418591	.198962
APT		1	.7258295	.6694535	.6904229	.7202139	.9048634	.2260788
ENG			1	.6490862	.3717686	.6203614	.7930685	.4055179
SOC SCI				1	.6015232	.6871024	.8508737	.3117009
NAT SCI					1	.6970754	.796316	-.026703
MATH						1	.8675186	.1970714
TOTAL							1	.2588391
HS GPA								1

while the aptitude test score percentile had the highest correlation of the test scores with a correlation of .1817. It was interesting to note that the correlation between the English test score and grade earned was a -.0506.

Two independent variables were to be used in the multiple regression analysis. Since a review of the literature revealed that the high school grades and aptitude/achievement test scores were the best predictor variables, it was decided that the senior year high school grade point average and the Florida test score (percentile) having the highest correlation to grade earned would be the independent variables used in this study.

Computation of MULFIT, a BASIC language computer program, generated the statistical data and the prediction equations which are presented as TABLE 8. A grade prediction table was developed for each of the four business subjects for which prediction equations were calculated. The table pertaining to the Principles of Marketing subject courses is presented as TABLE 9. While each of the four individual tables, cross correlation matrixes, and prediction tables are not included in the model package, the results of the multiple regression analyses and statistical computations are presented as TABLE 8.

TABLE 8

RESULTS OF MULTIPLE REGRESSION ANALYSES AND STATISTICAL COMPUTATIONS

PRINCIPLES OF MARKETING

Coefficient of Determination: .0592864
Coefficient of Correlation: .2434879
Prediction Equation: $Y = 1.442163 + .0060387 A + .25756G$
Error of the Estimate: ± .95 of one grade point

ECONOMICS I

Coefficient of Determination: .3997301
Coefficient of Correlation: .6322421
Prediction Equation: $Y = .3280156 + .021326 M + .25681 G$
Error of the Estimate: ± .78 of one grade point

ACCOUNTING I

Coefficient of Determination: .0440367
Coefficient of Correlation: .209492
Prediction Equation: $Y = 2.212929 + .0105739 E = .16363 G$
Error of the Estimate: ± 1.06 grade points

INTRODUCTION TO BUSINESS

Coefficient of Determination: .0870622
Coefficient of Correlation: .295063
Prediction Equation: $Y = 1.239229 + .007878 E + .28062G$
Error of the Estimate: ± .86 of one grade point

Y = Predicted grade
A = Aptitude twelfth grade test score (percentile)
G = Senior year high school grade point average
M = Mathematics twelfth grade test score (percentile)
E = English twelfth grade test score (percentile)

TABLE 9

PRINCIPLES OF MARKETING

GRADE PREDICTIONS USING THE FLORIDA TWELFTH GRADE APTITUDE TEST SCORE AND THE SENIOR YEAR HIGH SCHOOL GRADE POINT AVERAGE

		GRADE POINT AVERAGE						
		1.0	1.5	2.0	2.5	3.0	3.5	4.0
	10	1.76	1.88	2.02	2.15	2.28	2.40	2.53
	20	1.82	1.95	2.08	2.21	2.34	2.46	2.59
	30	1.88	2.01	2.14	2.27	2.40	2.52	2.65
	40	1.94	2.07	2.20	2.33	2.46	2.59	2.71
APTITUDE SCORE (PERCENTILE)	50	2.00	2.13	2.26	2.40	2.51	2.65	2.77
	60	2.06	2.19	2.32	2.45	2.58	2.71	2.83
	70	2.12	2.25	2.38	2.51	2.64	2.77	2.90
	80	2.18	2.31	2.44	2.57	2.70	2.83	2.96
	90	2.24	2.37	2.50	2.63	2.76	2.89	3.02
	99	2.30	2.43	2.56	2.68	2.81	2.94	3.07

When this table is used as a predictor of Marketing I grades, 68% of the students will achieve grades with ± .95 of the values in the table.

The table was prepared using the equation:

$Y = 1.442163 + .0060387A + .25756G$
Y = Predicted Marketing Grade
A = Twelfth grade aptitude test score (percentile)
G = Senior high school year grade point average

CHAPTER IV

SUMMARY

This research examined the possibilities of developing and evaluating a relatively simple-to-use instrument which could be used by professional counselors, business administration instructors, and para-professional program advisors, when advising potential business students.

The study was essentially a discriminate prediction study, using certain independent variables (high school grades and percentile scores on the Florida twelfth grade tests) as the bases for predicting success in specific business courses. Tables were developed for use as the prediction instruments in four different business subjects - Accounting, Economics, Marketing, and Introduction to Business.

An evaluation of the prediction instruments and the regression formulae developed indicated that a large percentage of variations in attempting the prediction of success remained unexplained, but enough was explained to encourage counselors and instructors at Brevard Community College to use the specific prediction formulae presented, in efforts to better counsel students towards or away from specific business courses.

SIGNATURE PAGE

I certify that I have read and am willing to sponsor this Major Applied Research Project submitted by MAURICE H. BOUTELLE. In my opinion it conforms to acceptable standards and is fully adequate in scope and quality, as a Major Applied Research Project for the degree of Doctor of Education at Nova University.

Don A. Morgan, MARP Advisor

I certify that I have read this Major Applied Research Project and in my opinion it conforms to acceptable standards for a Major Applied Research Project for the degree of Doctor of Education at Nova University.

William C. Prentiss
Cluster Coordinator

This Major Applied Research Project was submitted to the Central Staff of the Nova University Ed.D. Program for Community College Faculty and is acceptable as partial fulfillment of the requirements for the degree of Doctor of Education.

Ross E. Moreton
Central Staff Committee Member

UNIVERSITY OF CALIF.
LOS ANGELES

APR 22 1977

CLEARINGHOUSE FOR
JUNIOR COLLEGES